ELECTRICAL REVIEW

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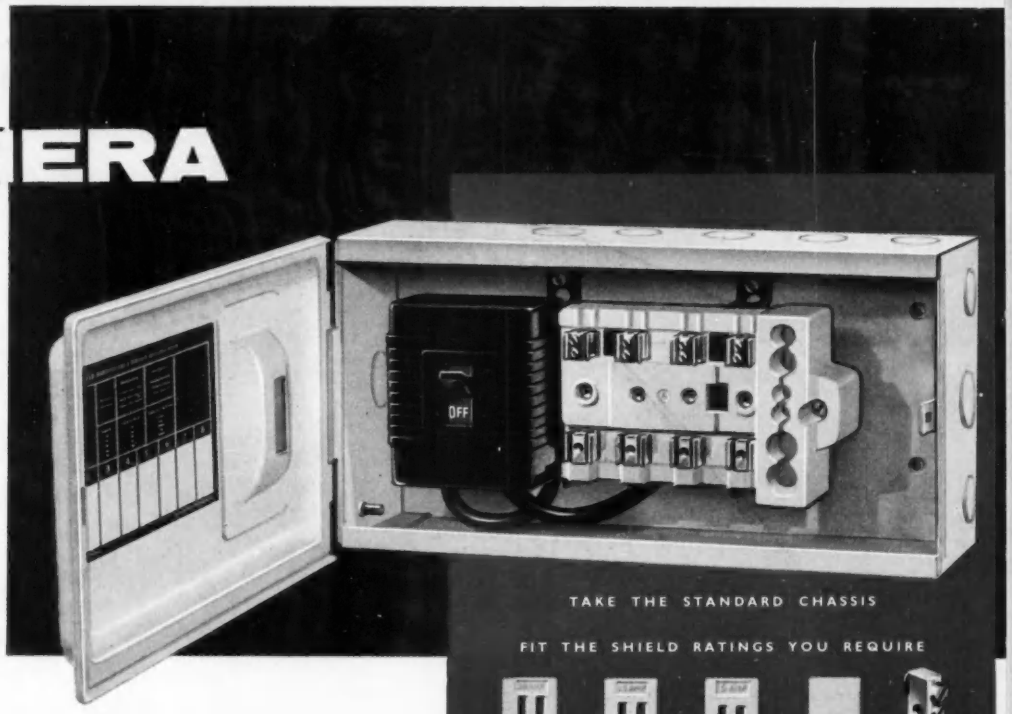

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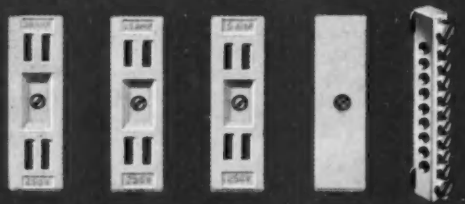

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ELECTRICAL REVIEW

5 June 1959 Vol. 164 No. 23 Established 1872

Electricity Supply and Demand

IN his address as President of the British Electrical Power Convention at Torquay on Tuesday, Mr. C. R. King presented a good picture of the ups and downs of electricity supply during his forty years' experience in the industry. After the first world war conditions were very patchy. Some of the 600-odd undertakings were making provision for future development while others were merely keeping up with a not very active demand. Upon the whole the system was very unsatisfactory and it was realised that some form of Governmental action was necessary.

Action took the form of the establishment of the Electricity Commissioners who were able to exercise considerable influence but still did not succeed in bringing about the co-ordination, by means of Joint Electricity Authorities, which the 1919 Electricity (Supply) Act envisaged. Later the Central Electricity Board, under the 1926 Act, exercised a more general control of generation but there remained a variety of distribution authorities, many of whom had no sense of direction. The final result was nationalisation which, as Mr. King showed, however repugnant to many people, has brought about coherence and definite policy. For one thing it has made it possible, after some years of struggle, to relate supply with demand, and also to plan for the future.

That future is an electric one in every sense and direction. Already the people of this country (and indeed of the whole civilised world) are convinced, and for most of them the use of electricity has become second nature. It is, however, necessary to show them how to use it advantageously, both from their own and the Electricity Boards' points of view, so that electrical service shall be recognised as the most efficient and economical means of running home, office and factory.

For their part the Electricity Boards must see that the service is adequate and constant. To increase electricity's contribution to the standard of living (the Conference theme) more money has to be spent on distribution systems without, however, any falling behind on the generation side. It seems as though this is now being attended to but there are heavy arrears to overtake. From this work, and the provision of equipment and appliances

to the consumers, the manufacturers will derive much business and by spreading their overhead charges over larger production will be able to keep their export quotations down to a competitive level. The electrical contractors, too, have an important role in educating consumers to require adequate, sound and safe installations. Co-operation is a much overworked word but here it is imperative if steady and ordered progress is to be made.

QUESTIONS UNASKED

No one in the electrical industry doubts that there will be a continued steady expansion in the use of electricity and that it will become increasingly competitive in industry and the home. But confidence in the future is no excuse for present complacency. Why, for instance, in view of its many advantages, is electricity not more widely used? (About 15 per cent of all domestic and commercial consumers, we are told, use less than one unit a day.) Some of the reasons, such as the amount of capital available for electricity supply, are outside the industry's control (though it could often state its case more forcibly). Others, including the quality of selling techniques and consumer relations, are internal matters and should be tackled energetically.

In his paper at this week's Electrical Power Convention Mr. A. N. Irens asked many pertinent questions on these subjects that are worthy of continued study by the Area Boards and the supply industry as a whole. But it is to be regretted that he did not broaden his approach and ask questions more appropriate to a gathering at which all sides of the electrical industry were represented. For example, are manufacturers, contractors and others playing a sufficiently active part in promoting the greater use of electricity? And why, when co-operation does take place, as for instance on adequate wiring and testing appliances, and there is a valuable opportunity for demonstrating the industry's progressive attitude, is progress so slow and uncertain?

INSTALLATION ENGINEERS

The term "electrical contractor" does not really describe the men or firms who do their job properly. It may be fair to apply it to the practitioner on a small scale, but even the small man may be something more. As Mr. Colin Hyams showed in his Convention paper, the "installation engineer" (as he may more properly be called) is not merely a fixer of other people's equipment. To his smaller clients he is consultant and adviser as well as the provider of the craftsmen who do the work. Even for the larger concerns who employ him his practical experience is of great value. Although Mr. Hyams was careful to say that the installation engineer did not usurp the functions of the electrical consultant, there are many instances in which clients leave the design and layout of an installation very largely to his judgment.

Many of the accessories which are in current use were originally designed by electrical contractors who still suggest new designs or modifications of items produced by others. The paper indicated very well how much a good installation engineer has to know and in what a variety of ways he has to exercise that knowledge.

COMPACT NUCLEAR REACTORS

We gave brief details in our issue of 15th May (page 899) of the eight nuclear propulsion systems which are being considered by the Admiralty for use in surface ships, and in this issue we describe some of these in greater detail. The reactors under consideration are very compact units; indeed they must be to accommodate them on board ship. The development of these reactors may have a very useful bearing on the future development of similar types for use in electrical generating stations of moderate output.

The graphite-moderated gas-cooled reactor of the type now being built for the British nuclear power programme is a very bulky affair. This is clearly a great disadvantage for certain applications. The very compact reactors which are now being developed for ships have thermal outputs in the range 100 to 200 MW and this may make them more suitable for installation in some of the underdeveloped or less industrialised countries.

INDUSTRIAL USE OF RESEARCH

The two annual open days of the National Physical Laboratory at Teddington are an excellent opportunity for members of industry and organisations dealing with scientific and educational matters to see something of the Laboratory and the work being carried out, and this year it is anticipated that some 200 exhibits will be seen by more than 4,000 visitors. Even so, the director of the Laboratory, Dr. G. B. B. M. Sutherland, considers that it would be to both industry's and the Laboratory's advantage if the number of visitors were greatly increased.

From the representatives of industry the National Physical Laboratory would be able to learn a great deal of the industrial viewpoint, while industrialists, in addition to acquiring information on the wide range of subjects at present undergoing investigation, might be able to appreciate some practical applications arising from the research programme. In part this is achieved by the interchange of people between industry and the Laboratory, some 100 members of industry working in the Laboratory and 30 of the Laboratory scientists working with industry. This is a process which has also made it possible for research at the N.P.L. to proceed more rapidly as a result of the extra manpower made available, and this process could with advantage be enlarged.

The Laboratory has been visited by representatives of many overseas countries, including the U.S.A. and the Soviet Union, who, no doubt, take a great interest in all they see, while members of the N.P.L., in turn, visit their overseas counterparts. Naturally the Laboratory does not wish to restrict or prevent this mutually advantageous interchange. It is to be hoped, therefore, that, in view of the importance of our own country's maintaining its lead in technology, our electrical industry will make every use of the fruits of the Laboratory's work.

Power Convention at Torquay

GATHERING OF ALL SECTIONS OF THE INDUSTRY

THIS year's British Electrical Power Convention held at Torquay this week attracted something like 1,600 delegates and visitors, representing all sections of the electrical industry. Many arrived last week-end and the hotels soon assumed their "conference" look. In the exhibition marquee, situated handily near the Pavilion in which the business sessions have been held, there was the usual Sunday rush to have the stands completed on time, but, as usual, everything was in order on Monday.

It was a good idea to arrange the opening of the Exhibition on Monday afternoon, instead of in the evening, as has been customary. The President (Mr. C. Robertson King, C.B.E.) was introduced by Mr. W. N. C. Clinch, chairman of the Exhibition Committee. Mr. Clinch mentioned that the South Western Electricity Board was well represented at the Exhibition to back up the Convention theme "Electricity: Its Contribution to the Standard of Living". He went on to say that the Exhibition was the "stage" of the Convention upon which electricity's part in modern life was demonstrated.

Mr. King, in declaring the Exhibition open, said that the display started in the days of the Incorporated Municipal Electrical Association when the Association and the manufacturers considered it wise to have an exhibition as a part of the annual Convention. If it was necessary or desirable then it was even more so now when the manufacturers were represented at a Convention of all sections of the electrical industry. He was glad to have an Exhibition in his year of presidency although he was now a "wholesaler" and no longer a "retailer"; the Exhibition dealt mainly with the Area Electricity Boards' work. He thanked the exhibitors for organising their displays and said that the Exhibition provided a meeting place for the Electricity Boards' people to meet many who were not actually delegates to the Convention.

In conclusion Mr. King thanked the Electrical Development Association which was responsible for the Convention publicity and for the organisation of the Exhibition and paid a tribute to Mr. J. I. Bernard, director and secretary of E.D.A., and his staff. He hoped that delegates would pay more than one visit.

Mr. Clinch then presented electric coffee percolators to the Mayoress of Torquay (who was present with the Mayor) and Mrs. King.

At the opening of the Convention at the Pavilion on Tuesday morning some merriment was caused by the gradual emergence of the "front bench" of the Convention Council from below the stage on the orchestra lift. Mr. King, in some preliminary remarks, expressed the regret of all the delegates at the death of Sir Claude Gibb, the vice-president. He was, said Mr. King, a man of sterling worth, a friend to everybody and a tower of strength to the industry. The President also referred to the more recent death of Sir John Dalton, a past-president of the Convention. Sir John was latterly on the manufacturing side of the industry but he had been one of the pioneers of electricity supply. Introducing the Mayor of Torquay (Alderman J. F. Haarer), Mr.

F*

Delegates at the opening of the Exhibition.

King referred to his many Corporation activities and to his achievements as a sportsman.

The Mayor, in extending the civic welcome to the delegates, said that although he himself was a "new boy", the British Electrical Power Convention was paying its fourth visit to Torquay. They were proud to have been the birthplace of the Convention in 1949 when Lord Citrine was the first President. He was also proud to be able to say that they had always managed to produce the right weather for the Convention. He hoped that the delegates would enjoy their stay and that the proceedings would be of benefit to all. The Mayor said that the Exhibition was of the greatest interest; it had given him a very good idea of the scope of the electrical industry—an opportunity which was not ordinarily available to the man in the street.

After thanking the Mayor for his welcome, Mr. King delivered his presidential address a summary of which appears in later pages.

A vote of thanks to Mr. King was proposed by Sir Henry Self who described the presidential address as an extremely able and absorbing review of the electricity supply industry. He referred to Mr. King as a man who had come up the hard way; his pioneering labours had stood him in very good stead to provide an address which was steeped in human interest, showing as it did that electricity was closely related to the standard of living. Sir Henry mentioned telegrams from Sir George Nelson expressing his regret at being unable to attend the Convention owing to ill health. Sir George had sent a second telegram in which he said he had now read Mr. King's address and thought it was a magnificent piece of work.

Sir Henry then emphasised the importance of recruiting new men into the electricity supply industry and said that the presidential address would be an invaluable document in this connection for many years to come, as it told the potential recruit all about the workings of the industry and how it had grown up.

Viscountess Kilmuir, D.B.E., president of the Electrical Association for Women, took the chair at the Association's Convention luncheon held at the South Devon Technical College. The luncheon was very successfully cooked and served entirely by students of the College. In proposing the toast "The Borough of Torquay," Lady Kilmuir welcomed the Association's friends and delegates to the Convention and thanked the College for the excellent service they had given. She said that she had an easy toast to propose for Torquay excelled in beauty and weather; the town had been very well endowed by Nature and it was an ideal place for the modern convention—a combination of business and pleasure.

They were grateful to Miss F. M. Pugh, the president of the Torquay Branch of the Association, a county alderman, and chairman of the Governors of the College, for all that she had done. Lady Kilmuir concluded by thanking the Mayor of Torquay for the excellent arrangements made for the Convention.

Replying to the toast, the Mayor said that women were playing a more and more important part in the public life of the country. When the E.A.W. was founded in 1924 electrical apparatus was not so good as it had since become and comparatively few people cooked electrically. But remarkable changes had taken place and electricity now took an important place in the community. In all this the Electrical Association for Women had done a great deal. His Worship referred particularly to its work in the training of demonstrators and domestic science teachers and to the Caroline Haslett Trust. The Association's encouragement of the training of women had brought many recruits to the electrical industry.

Miss F. M. Pugh then proposed the toast, "The British Electrical Power Convention". She said that the E.A.W. had been associated with the Convention for a long time and with one exception had arranged a Convention luncheon. She recalled that she had welcomed the Convention when her father was Mayor and had then had the pleasure of meeting the late Dame Caroline Haslett.

As chairman of the Governors of the College she was pleased to have the members as guests. They were in a new department of the College designed to train young

men and women for the hotel industry, aiming to raise the standards of hotel keeping not only in Torquay but all over the country. It should be appreciated that the students were the future " consumers " of electrical equipment.

Miss Pugh said that electricity made it possible to distribute industry in beautiful buildings in beautiful surroundings, an important contribution to the country's economy. In this connection she referred to the new Standard Telephones and Cables establishment at Paignton (next to Torquay) and said that this had made a great contribution towards raising the level of electrical education in the area.

The Convention papers were of great interest to the members of the Association and to the general public. Nuclear power was recognised by the E.A.W. as a great future development and it was their task to interpret technical teaching into the language of the housewife. The papers on electrical installation work linked up with the theme of their current campaign—" Electricity for Everywoman ". The E.A.W. was happy to be attached to the electrical industry and hoped to continually strengthen the bond between them. She ended by saying that Mr. King had been a friend of the Association for many years.

In the course of his response. Mr. King said that the service by the students had been an " eye-opener " to them all. He was proud to respond to the toast because he had been a strong supporter of the E.A.W. from its inception. Caroline Haslett was remembered with affection by all. The Association was fortunate in having Miss Mary George as her successor and he was glad to have had a voice in her selection for the post. Members of the Association were able to tell manufacturers how their appliances should be designed and they were a most useful link between the public and the Electricity Boards.

Lady Kilmuir wound up the proceedings by paying a tribute to the students who had given their services.

The afternoon session was devoted to the presentation and discussion of the paper by Messrs. F. H. S. Brown and J. Henderson on " Progress on the First Nuclear Power Stations—Bradwell, Berkeley, Hinkley Point and Hunterstone ". The paper is summarised on page 1034 and the discussion (with those on the other Convention papers) will be reported in next week's issue. The day was concluded with a reception by the Mayor of Torquay at the Town Hall and dancing.

Mr. A. N. Irens read his paper, " Priority One " at Wednesday morning's meeting. Concurrently the ladies were entertained at coffee by Mrs. C. R. King. Two papers were presented and discussed at the afternoon session—" The Scope of Installation Engineering ", by Mr. C. C. Hyams, and " The National Inspection Council for Electrical Installation Contracting ", by Mr. E. J. Sutton. There was no " official " evening function but several manufacturing firms held parties.

Yesterday (Thursday) morning Mr. O. W. Humphreys gave his lecture-demonstration under the title " Lighting and the Common Weal ". At the annual dinner in the evening, held at the Palace Hotel, the principal guest was Mr. P. J. Noel-Baker, a former Minister of Fuel and Power.

This morning the popular " Electrical Forum " is taking place at the Pavilion; the panel is to consist of Sir Christopher Hinton, Mr. W. S. Lewis, Mr. H. G. Nelson and Sir Henry Self. This is to be followed by the annual general meeting at which the election of Lord Chandos as president will be announced.

1—Mr. and Mrs. W. C. Kennett and Mr. P. Evans. 2—Mrs. Thorogood and Mr. and Mrs. J. Flood. 3—Mr. J. I. Bernard with Mr. and Mrs. R. Berry. 4—Messrs C. A. Turner, S. G. Nimrod and H. G. Palfreman. 5—Mr. and Mrs. K. W. Marten.

Mr. C. R. King delivering his presidential address on Tuesday morning.

PRESIDENTIAL ADDRESS

MR. KING REVIEWS PROGRESS

THE introductory passage of Mr. C. R. King's address as President explained that the Convention theme—" Electricity and its Contribution to the Standard of Living "—was designed to cover the past history of electricity supply and the impact of its development upon national life today. He said that to present a clear picture of the greatness of the industry's achievements it was necessary to understand the unstable foundation upon which the present intricate organisation was built.

When he entered the industry in 1919 it was difficult to find money for power stations and distribution networks and supplies were restricted in character. Industrialists were reluctant to change their tried methods of power production when the electricity supply was so unreliable. It was rewarding to realise how much was owed to the pioneers who surmounted innumerable difficulties and laid the foundations of the present great industry.

Mr. King proceeded to deal with the major events since 1919 when the Act establishing the Electricity Commission was passed. The rapid development after the first world war prompted the Government to set up the Weir Committee whose report resulted in the 1926 Electricity Act, setting up the Central Electricity Board. That Board's duties were to see that large and efficient power stations were provided and interconnected by e.h.v. transmission lines, and its inception gave a great impetus to the development of electricity supplies, especially in the many areas hitherto without electricity. Efficiency and reliability improved and by 1939 the country as a whole had a cheap and abundant supply. Thus it was that in the second world war the industry was able to cope with major industrial developments of vital importance to the war effort.

By 1939 the C.E.B. had succeeded in reducing spare generating plant from 45 per cent to about 17 per cent of the total load. During the war load growth had to be met, generally speaking, from existing plant capacity and the end of the war found the industry stretched to almost breaking point both in generating plant and distribution. Fourteen years later the country's distribution system had not fully recovered.

In 1945 it was announced that the Government intended to nationalise electricity supply. Although there was strenuous opposition to the proposal it had been recognised long before that there was need for legislation to bring together the conflicting interests of large and small municipalities, large power companies and small distribution companies—some 540 undertakings. Whatever the merits or demerits of nationalisation as an ideology, the President said, there could be no dispute about the magnitude of the progress and success achieved since 1948, the vesting date for the industry. It might be said that the industry would be even more successful if it could be freed from that type of criticism which was entirely political in character.

Speaking of the way in which the shortage of generating plant was overcome, with the wholehearted co-operation of the manufacturers, Mr. King said that during the first ten years after nationalisation new generating stations were put into commission at an average rate of one every two months, apart from extensions of existing stations. He paid a tribute to all responsible, above all to Lord Citrine, the chairman of the Central Authority, for his wise and forceful leadership.

An Organisation Review Committee appointed by the Central Authority in 1954 prepared a report but during its period of preparation the Government set up the Herbert Committee for almost the same purpose. The Organisation Review Committee and the Herbert Committee both suggested the establishment of a Generating Board under the Central Authority but the 1957 Act provided for an entirely separate Generating Board. The Act also set up an Electricity Council which was responsible for the policies of the industry, to be implemented by the individual Boards; but the Council could not compel obedience to its decisions. The constitution of the Council had been such that it

Opening of the Exhibition. Behind the President are Mrs. King and the Mayor of Torquay.

had been possible so far for it to reach unanimous decisions on all important matters and the President hoped that the industry would continue to be able to solve its own problems.

In a summary of the Central Electricity Generating Board's operations Mr. King drew attention to the position created by the increasing size of generating units. This meant that instead of seven or eight generating stations a year, the Board's programme was for four a year two of which would be nuclear stations. Because of this there was bound to be some slowing down on the manufacturing side. This was aggravated by the decision of the Generating Board that 90 per cent plant availability was adequate to meet the demand.

On the subject of the bulk supply tariff, the President said that the Generating Board had decided that its tariff for 1959-60 should be based on an increased kilowatt charge and a correspondingly reduced running charge. This was designed to encourage improvement in the load factor which was necessary, particularly with the advent of nuclear power stations with high capital and low running costs. Some Area Boards had quickly responded by altering the shape of their retail tariffs to conform with the new bulk supply tariff.

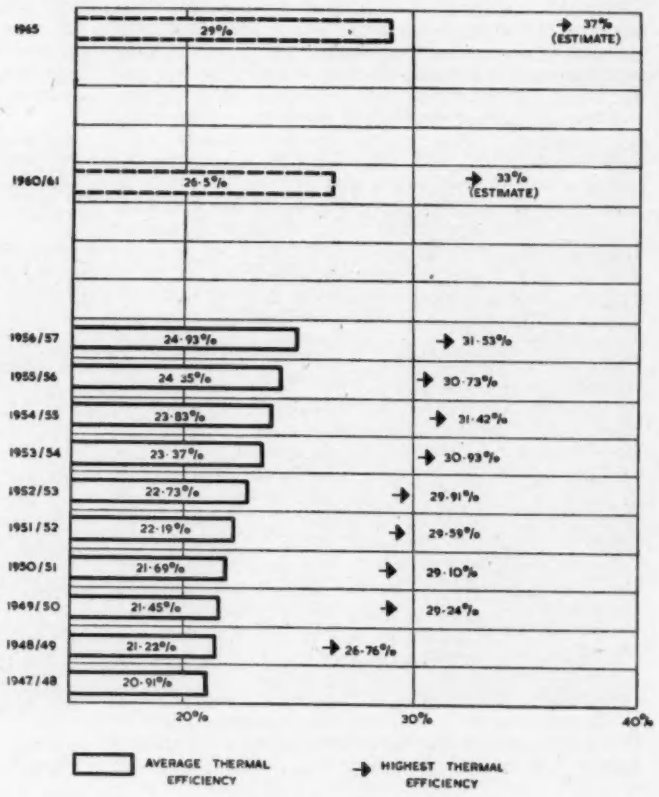
Work was in progress on the 275 kV grid but the rapid growth of generating capacity made it essential to reinforce the existing grid lines. A partial solution of the problem might be found in the stepping-up of the main transmission voltage to 380 or even 400 kV.

The President then turned to the problems of the Area Boards among which system reinforcement was prominent. Generating stations and transmission lines were planned five years ahead and distribution systems at least three years. Once contracts had been placed and work commenced it was virtually impossible to halt the spending at short notice and the burden of capital cuts had to be borne by short-term (often quite urgent) projects.

More and more finance would have to be found from within the industry and the desire would be to do this without unduly raising prices, even though this would be fully justified, considering the rise in the prices of other commodities. It was clear that the productivity of the industry had been steadily increasing during the last eleven years. If that increase continued it should help to meet the demands of self-financing. Area Boards would, however, have to see that their selling organisations were second to none if they were to maintain the rate of growth at the present high level.

This survey had shown broadly how electricity had contributed to the better living enjoyed by practically everybody compared with forty years ago. With the expectation that generating costs at future nuclear stations would be at least no more than the present costs at conventional stations, and possibly less, tremendous strides should be made during the next decade or two in providing cheap and abundant supplies of electricity for all the manifold purposes affecting the daily lives of the people.

It had become almost impossible to keep men employed on the land unless they were given the facilities—of which electricity and water were the most important—enjoyed by the town dweller. The electricity supply authorities were fully alive to this and Area Boards were actually ahead of their original programme in spite of financial stringency.



Ten-year improvement in thermal efficiency of power stations in England and Wales
(From the Presidential Address)

In the early 'thirties only one house in three had electricity and more often than not this was used for lighting only. Mr. King showed how the position had changed, although he pointed out that the market for electric cooking was still largely untouched because of the effective competition of gas. Wages had risen at a much greater rate than the price of electricity so that the householder who kept a careful budget could set aside the same proportion of his weekly earnings as in 1948 and obtain three or four times as much electricity.

Export trade depended a great deal on home sales and as the manufacturers had kept pace with the supply industry's demand for turbines, boilers, generators, cables, transformers, switchgear, domestic appliances, etc., they had also developed a substantial export business.

One had heard the word "saturation" mentioned but every year saw new uses for electricity and new devices which required electricity in still greater quantities. More and more power was being used in industry, there was a huge railway electrification programme, and better lighting in homes, factories, offices and highways. The uses of electricity for industrial and domestic heating were only just beginning to be realised and further developments in floor warming, carpet heating and space heating generally would ensure substantial increases in the use of electricity in this field.

The President concluded by drawing attention to the necessity for the proper education and training of the people in the electrical industry, particularly for the higher posts. For those possessing the highest technical, scientific or administrative qualifications there was almost unlimited scope for advancement and all branches of the industry should combine in an effort to attract the youth of today.

NUCLEAR POWER PROGRESS

COMPARISON OF STATIONS UNDER CONSTRUCTION

TUESDAY afternoon's paper, dealing with progress on the first nuclear power stations—Bradwell, Berkeley, Hinkley Point and Hunterston, was presented by Mr. F. H. S. Brown (full-time member, Central Electricity Generating Board) and Mr. J. Henderson (chief engineer, South of Scotland Electricity Board). The bulk of this paper was taken up by individual descriptions of the four power stations but set out in such a way as to facilitate comparison. In each case a description was given of the site, the site layout, the constructional programme, foundations, reactors, blowers, boilers and ductwork, turbine house and circulating water system.

After dealing with the nuclear power station construction programme in a general way and describing the events leading up to the placing of contracts for the stations under construction, the authors pointed out that the design of a nuclear station must be such that not only did the final result form a coherent, workable and economic generating unit but also such that the station could be constructed rapidly and economically. The importance of this last-mentioned point was not always recognised. Not only were capital costs reduced by a design which permitted a logical sequence of construction, but the money expended in construction was not productive until the station became operational. Since nuclear stations of the type discussed in the paper had a total cost of between £40 and £70 million each, the capital charges towards the end of the construction period would be over £250,000 per month per station. Thus, every month in which non-productive costs could be replaced by revenue earning generation was of the utmost significance.

The stations were basically similar to Calder Hall, that is, they employed graphite-moderated gas-cooled reactors, the gas circulating through heat exchangers which generated steam to drive the turbines. The control of the reactors was similar in principle to that at Calder Hall but the increase in rating emphasised the importance of control of any local flux distortions which might appear. Control was therefore subdivided to a greater extent than in Calder Hall, and each sector of the reactor had a system of control rods acting locally and controlled from the local gas outlet temperature. Reactors were ultimately safeguarded by flux-sensing instruments which, because of their delicacy, could not at present be subjected to the conditions inside a reactor. In the four stations considered three positions for continuous flux measurement were provided, spaced equidistantly around the reactor. The temperatures attainable in these early reactors were limited by the materials used in the fuel elements and the maximum steam temperature was about 370 deg. C. This meant that the thermo-dynamic efficiency of the steam cycle was low and as a result the heat rejected

Top : *Messrs. D. B. Irving, F. H. S. Brown and P. B. Etheridge.*
Bottom : *Mrs. J. Henderson, Lady MacColl and Mr. J. Henderson.*

to the circulating water per kilowatt was higher than that of contemporary coal-fired stations.

Circulating water was taken from the sea and the problems involved in the heavy coastal works were special to each site. The quantities of water involved were about 1 gall/min/kW, giving totals of 17 to 30 million gall/hr. The circulating water ducts and associated pumping equipment were large and expensive.

The constructional sequence employed for the building of these nuclear power plants was largely governed by the methods employed for building the reactor pressure vessel and its associated boilers. The pressure vessel was a large heavy structure, about 50 to 70ft. in diameter, built of steel 3 to 4in. thick and it could not be lifted as a unit. To some extent it had therefore to be fabricated *in situ*. When completed the pressure vessel was surrounded by a concrete biological shield 7ft. or more thick and the construction of this shield itself was a major undertaking.

Since the need for speed was paramount it was vital to investigate every possible scheme which would enable the lengthy operations of biological shield and pressure vessel construction to proceed simultaneously and, in fact, different solutions had been adopted on different sites. At Bradwell, Hunterston, and Hinkley Point as much as possible of the pressure vessel was constructed away from the shield by the welding together of sections as large as practicable; these were then lifted into the shield when the vertical walls were complete, thus leaving the minimum of welding to be done within the shield.

This plan required special lifting facilities and each of the sites used a Goliath type of crane with tracks at ground level spanning the reactors. The use of such a crane imposed certain characteristics on the site layout. The reactors had to be in line and reasonably close together and the pressure vessel fabrication facilities, etc., served by the crane had also to be in line with the reactors. The crane could also be used for the erection of the heat exchangers and this, too, affected the site layout.

On the Berkeley site a different solution had been found to this problem. Here in principle the pressure vessels had been constructed *in situ*. The vessels had been built inside steel containers, frequently referred to as thermal shields, which also formed the internal shuttering for the concrete biological shields. By this means pressure vessel fabrication and biological shield construction had proceeded concurrently and the use of the Goliath crane avoided. Since the crane was not available for lifting the boilers into position these were handled individually by the use of gin poles, as at Calder Hall.

As already indicated, the question of the time and method of construction of the pressure vessel and its associated shield was the main pace-maker in the programming of work on site. When the pressure vessel shell had been completed, the top of the biological shield had to be constructed as quickly as possible so that work could proceed on the installation of fuel charge, discharge and control equipment, instrumentation, and so forth, on the pile cap. This was quite a complicated structure because of the need to provide shielding and coolant passages round the standpipes used for charging and discharging fuel and for control rods. In some stations the pile cap must at the same time be capable of supporting fuelling machines weighing several hundreds of tons. The remainder of the heavy work, such as the installation of the boilers and conventional generating plant, large though these operations were, could in general be completed relatively comfortably within the time required for the erection of the reactor.

The authors concluded their general discussion of the constructional work by referring to a point not encountered in the construction of coal-fired power stations, but of paramount importance in nuclear work. This was the establishment of clean, almost clinical, conditions within the reactor circuit since it was essential that the reactor when commissioned should not contain any extraneous matter.

1.—Messrs. W. Milner, H. S. Smith and G. H. Fowler. 2.—Messrs. L. J. Luffingham, W. H. Dunkley, D. P. Sayers and T. Penman.
3.—Messrs. F. C. Duffield, R. Cook, H. McCartney, J. Pearson Smith and M. Fletcher Cooper. 4.—Messrs. A. C. Thirtle and C. T. Melling.

"PRIORITY ONE"

MAKING THE MOST OF ELECTRICITY

IN the paper which was presented on Wednesday morning Mr. A. N. Irens, M.Sc., M.I.E.E., said that his aim was to demonstrate the position of electric power as "priority one" among the fuel industries of Great Britain, and, in important respects, as "priority one" in the life of the country. The basic aim of the electricity supply industry was to provide a reliable supply of electricity at a constant voltage and at the lowest possible price to all who wanted it. Mr. Irens devoted the greater part of his paper to a detailed examination of the place that electricity occupied in the modern world, the special nature of its contribution to the industries that sustained the British economy and the main considerations that affected its development as a major contributor to an expanding society geared to meet growing competition overseas.

He compared the pattern of production and demand for electricity in this country with that in certain European countries and the United States and referred to the contributions made by electricity to improved industrial conditions and productivity. Despite the increase in its use electricity was still a small item in industrial and domestic budgets. Only about 2½d. in the £ of national personal expenditure in Britain went on electricity, or 1/6th of the amount spent on drinks or tobacco and 3/5ths of that spent on books and magazines. Again, while retail prices in general increased between 1924 and 1958 by over two and a half times the overall revenue per unit of electricity in 1958 was slightly lower than in 1924.

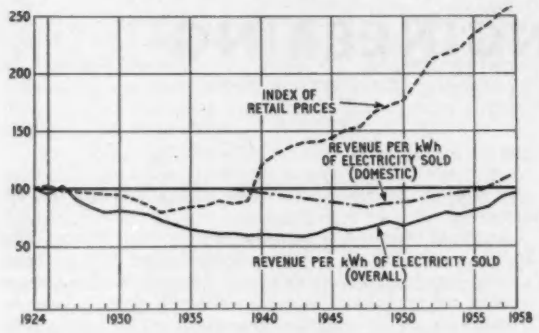
After some reflections on electricity service and the consumer, including such aspects as safety and fair trading, Mr. Irens discussed the economic position and in particular the industry's demand for capital and its ability to use it wisely. The supply industry welcomed its accountability but was frankly sceptical of the frequency with which the plant was dug out to have its roots examined and pruned. A period of quiet steady growth would be most fruitful. Because the industry was nationalised it tended to receive an undue share of attention and direction; it was told, for example, to be competitive but not too competitive.

1.—Messrs. L. H. Welch and H. Esther. 2.—Messrs. F. W. Skelcher, O. S. Woods and R. L. Batley. 3.—Messrs. I. A. A. MacDonald and A. B. H. Clarke.

(Below): *4.—Messrs. B. D. Youatt, W. A. B. Nettleton and C. Cameron Kirby. 5.—Messrs. J. E. Mayes, E. J. Corbett and R. Mould-Graham.*

Turning to an appraisal of future needs and problems, Mr. Irens said that while the supply industry's achievements since the war deserved more public recognition than they had had, those working in the industry had no right to be complacent. They should inquire whether the industry was doing all it might and whether the nation was drawing the full advantages from the possibilities that electricity offered. If the answer was "No", what ought to be done about it in terms that were both realistic and practicable? Mr. Irens hoped that constructive suggestions would emerge from the discussion of such questions at the Convention.

Why, for instance, in view of the immense benefits it brought, was electricity not more widely used? Was it because of the strength of competition, consumer prejudice or ignorance, or because of lack of capital? Since freedom of choice should not be withdrawn, it was up to the industry to demonstrate to customers the solid and signal advantages, economies and comforts that derived from the use of electricity. The industry had an almost perfect case but were they making it through effective merchandising and effective and consistent publicity conducted in the right tone of voice? In Mr. Irens' opinion they still had very much to learn. To promote the sales of equipment and appliances the consumers



Comparison of retail and electricity prices in England and Wales

should, within the limits of sound social finance, be given full facilities to buy on credit.

Again, while the industry could look back with satisfaction on what had been done to improve the reliability of supply, much remained to do. On the generating side the stage was now being reached when perhaps on only three days in one hundred years would there be any risk of supplies having to be disconnected on any serious scale, and even then the proportion thus interrupted would be small and the period short. Nevertheless, at present about one million consumers could not rely during severe winter weather on an absolutely satisfactory and invariable supply.

The remedy was capital for reinforcement and perhaps some reserve generating plant at strategic points. Mr. Irens suggested that just as a fairly clear standard for optimum production capacity had been achieved, so an equally acceptable yardstick of overall quality and reliability of service should be sought for the distribution side of the supply industry.

Though the electricity supply industry already commanded a thirteenth of the country's total annual capital investment, they could do with more. Mr. Irens believed that they could use it wisely and in a way which would bring greater revenue with greater productive power to the country as a whole and so secure a lowering of the price of electricity. The Convention should pronounce very positively on the need for a regular long-term capital budget for the supply industry. Electricity supply could not be expanded economically, or be properly programmed, unless the industry knew how much money would be available.

Another question the industry should ask itself was whether enough research was being done, and on the most rewarding lines. Was too much time being spent on the " hardy annuals " in their research programme and had the overwhelming impact of nuclear power been allowed to shift the emphasis too much from other fields ? More particularly, Mr. Irens said he would like to feel that the industry was deliberately hammering at the vital question of storage.

Recruitment and Training

It was also vital that the industry should get enough of the right men at every level. Training programmes and prospects for advancement must be strictly conditioned to the type of men obtained. It was useless, Mr. Irens emphasised, to bring men of brains and capacity into the industry unless they could be assured that their talents had scope for reward—and within a reasonable time. The industry needed clever engineers, men of intellect and judgment and men with commercial flair, but whether it was doing all it should to attract them was, Mr. Irens suggested, open to doubt.

In conclusion he said that those working in the supply industry knew that electricity was bound to increase in use, extent, reliability, convenience and relative cheapness. But they must ensure that the pace at which this took place was the correct one, and seek to secure by all legitimate means their due share of capital and men and employ them wisely.

Attached to the paper were appendices giving an analysis of the household budget and examples of the use of electricity by industry in South West England.

1. Mr. A. N. Irens and Sir John Pickles. 2. Messrs. R. M. Hawkins and R. P. Dean. 3. Mr. and Mrs. B. MacFadden with Mr. E. G. Batt. 4. Messrs. R. Brassington, J. E. Woodward, C. B. Cleland and G. R. Wibrow. 5. Mr. and Mrs. W. N. C. Clinch. 6. Messrs. J. H. Cosens and D. C. Lorkin

INSTALLATION ENGINEERING

WIDE AND VARIED SCOPE

MR. COLIN C. HYAMS, this year's President of the Electrical Contractors' Association, was the author of the first paper presented on Wednesday afternoon. He dealt with the scope of installation engineering and claimed that the installation engineer had been a key figure in the electrical industry right from its inception. It was the object of the paper to show that the job of the installation engineer was not merely to connect equipment designed and manufactured by others but that he had great responsibility in the wide and growing electrical industry.

Mr. Hyams first considered the factors affecting installation design, calling attention to the need for adequacy, flexibility and safety; to the necessity of employing materials and systems in the most suitable way; and to the importance of ensuring that the customer had an "economic" and convenient installation. An important part of the installation engineer's work was the maintenance and inspection of completed installations and many electrical contractors operated repair shops for the maintenance of a diversity of equipment. The author laid stress on the necessity for training young men both as artisans and for management and he referred to the electrical contracting industry's apprenticeship scheme.

The bulk of the paper consisted of descriptions in some detail of the most important classes of work with which the installation engineer was concerned. First, ships' installations were dealt with. Among the points brought out was the growing tendency to use a.c. in the larger vessels. After a mention of the types of generating plant employed, Mr. Hyams showed that the installation of ships' cables differed widely from land practice. Stud welding was now largely employed to provide fixing means and special precautions were necessary to meet marine conditions.

Lighting fittings and accessories were more robust than in land installations. All passenger ships had to have emergency lighting systems and frequently there were special arrangements for taking a supply from ashore or another ship. Power requirements were large, especially for driving winches and steering gear. Communication and information equipment involved the provision of many special instruments. Practically all the installation work in large passenger ships was carried out by the electrical staffs of the shipbuilders, owners or manufacturers. Intermediate-size ships also extended their work into the sphere of the specialist contractor, but a tremendous amount of work was done by qualified smaller firms.

In the vast majority of industrial electrical installations the installation engineer was called upon to design the complete work and he had to acquaint himself with the processes with which the factory was concerned, to ensure an installation of the correct type, and perhaps suggest how electricity could help with the processes. In choosing the type of distribution he must give attention to suitability, flexibility, safety and economy. He might have to draft the specification or, if a detailed one had been prepared, he might be able to suggest alterations and improvements. He must also arrange suitable tariffs with the electricity supply authority.

Mr. and Mrs. C. C. Hyams and Mr. and Mrs. A. H. Olson

Top: Mr. K. Druce, Mr. H. C. Timewell and Mr. and Mrs. E. G. Rowledge. Bottom: Mr. D. G. Dodds, Mr. and Mrs. C. Morley New, and Mrs. Dodds

Mr. Hyams emphasised that when the equipment had been installed it still had to be inspected and maintained and for this the installation engineer would need a skilled staff; examples were given of the points which had to be attended to. There followed brief details of the classes of equipment involved in industrial installations, including provision for power supply, lighting, space heating, process heating, control and instrumentation, etc., and an assessment of various wiring systems.

Commercial and public buildings, both new and already existing, were next considered. These covered a wide range of premises, from offices to hotels, in a variety of styles. Not the least of a contractor's functions, Mr. Hyams said, was the introduction and even initiation of new ways of using electricity in these establishments. The selection of the type of cable and the methods of

installing it called for great care and the author briefly reviewed some difficulties presented by modern methods of construction and the ways of overcoming them. Factors in load assessment, determining the capacity of the installation, were mentioned and supply intake arrangements were discussed.

Agricultural installations formed the subject of the next section of the paper and brief references were made to the various applications of electricity on farms—lighting, water heating, in the dairy, poultry breeding, pig rearing, preparing feedstuffs, and in the workshop. The special requirements in this class of work were set out, particular stress being laid on safety precautions.

In the installation of electrical equipment in large blocks of flats the electrical contractor was usually subsidiary to the architect or consulting engineer. In smaller dwellings he was generally expected to undertake the complete design and layout of the electrical installation. Some leading considerations mentioned were the provision of adequate and effective lighting and of a sufficient number of outlets; in the latter connection Mr. Hyams pointed to the economy and convenience of the "ring" wiring system. He also referred to the increased interest in electric heating, notably floor-warming systems. Matters to be taken care of in the installation of water heating and cooking were touched upon and some attention was given to the use of electricity in outbuildings and gardens and to special services, e.g. provision for the use of radio and television sets. As regards domestic wiring systems Mr. Hyams thought that the use of steel conduit was declining with the increased use of p.v.c. insulated and sheathed wires. The importance of proper testing and maintenance was emphasised.

The final section of the paper was devoted to a review of some of the special features of overseas installation work—of which British contractors had carried out a very large volume. Labour, shipment of materials, supervision, the provision of tooling and test equipment, the selection of wiring systems and maintenance were among the matters dealt with.

In his conclusion Mr. Hyams spoke of the need for close co-operation between the electrical contractor and Boards which, he said, already existed in a high degree through the medium of the Area Co-operation Committees.

INSTALLATION INSPECTION

POINTS FROM MR. E. J. SUTTON'S PAPER

ALSO on Wednesday afternoon, Mr. E. J. Sutton, M.I.E.E., chief technical officer of the National Inspection Council for Electrical Installation Contracting, presented a paper dealing with the objects and organisation of his Council. The first section of the paper was historical, tracing the endeavours made to secure safe electrical wiring since 1876 when possible fire risks were investigated by Mr. Musgrave Heaphy of the Phœnix Assurance Co., which later produced some rules. The I.E.E. Regulations had their origin as far back as 1882. Mr. Sutton surveyed the progress of these regulations and referred also to the Electricity Commissioners' Regulations of 1937.

Next the author dealt with the operations of the former National Register of Electrical Installation Contractors which was closed down when the National Inspection Council was formed. The N.I.C. sprang from the recommendations of an Organising Committee on which the I.E.E., the N.R.E.I.C., the Electrical Power Engineers' Association, the Electrical Trades' Union, the Electricity Boards and the contractors' associations were represented; the chairman was the late Mr. P. V. Hunter and the deputy chairman Mr. E. A. Mills.

The Organising Committee's recommendations were almost exactly followed in the formation of the N.I.C. A Roll of Approved Contractors was instituted; a number of inspectors were appointed; and membership of the Council was made available to a wide variety of organisations concerned in any way with electrical installations. It was agreed that Area Boards (in respect of their contracting departments) should be admitted to the Roll of Approved Contractors, as should members of the English and Scottish electrical contractors' associations and holders of certificates from the N.R.E.I.C. Future admissions to the Roll were dependent upon approval by the National Inspection Board (the executive body charged with the day-to-day business of the Council) on the reports of the inspectors.

The Council's work was financed largely by the English and Scottish Electricity Boards; the contractors' associations paid lump sums in respect of their members; and other approved contractors paid an annual fee of three guineas each. An appendix showed that, apart from the Electricity Council, the Electricity Boards and the two contractors' associations, about thirty other organisations were represented on the Council. These included electricity authorities outside Great Britain (e.g., the Manx and Guernsey undertakings), the I.E.E., consultants, manufacturers, architects, trade unions, farmers, rural industries, etc. In referring to the Scottish representa-

Mr. E. J. Sutton (right) with Mr. J. J. Looker on the N.I.C.E.I.C. stand at the Exhibition

1. Mr. A. E. McCormack, Mrs. D. H. C. Craig, Mrs. McCormack, Mrs. H. Cox, Mr. H. Cox and Mr. D. T. Leathwood. 2. Mr. and Mrs. C. W. Cawte and Mr. and Mrs. B. E. Leeson. 3. Mr. and Mrs. A. R. Gale. 4. Mr. and Mrs. J. D. Knox, Mr. and Mrs. T. Moore and Mr. N. A. Steel. 5. Mr. and Mrs. J. A. MacKerrell

tion Mr. Sutton mentioned the New Building (Scotland) Act under which the Secretary of State for Scotland could prescribe standards in building work, including the electrical installations. He hoped that the I.E.E. Regulations would become the recognised standard and stressed the importance of ensuring that the electrical contractor who was required to give a certificate that standards had been complied with would be properly qualified.

The next section of the paper covered inspection procedure. Mr. Sutton said that there were fourteen competent inspecting engineers who were all working to the same standards of inspection. Every contractor was inspected upon application for enrolment and periodically thereafter. Approved contractors were required to have adequate premises, tools and stock, as well as proper testing equipment, adequate experience and a knowledge of the Regulations.

The procedure of inspection and report was detailed. Reports were examined by the head office technical staff. New applicants had to satisfy the Council as to their compliance with the rules before being admitted to the Roll. Approved contractors were told either that their work was satisfactory; that they were neglecting to observe basic requirements fully; or were falling seriously short in their standard of work. In the last case they were asked to take remedial steps immediately and a further inspection was carried out three months later. In rare cases contractors had to be removed from the Roll. Approved contractors placed in this category, and new applicants, could ask for a further inspection if they questioned the accuracy of inspectors' reports.

The attainment of the objects of the N.I.C. depended as much on persuading the consumer of the advantage of employing approved contractors as on the actual enrolment of contractors. The names of over 5,000 approved contractors appeared in the last annual edition of the Roll and 17,500 copies of this were printed and circulated to the Electricity Boards for display in every showroom, to local authorities, consulting engineers, architects, surveyors, builders and other organisations likely to employ electrical contractors in a reasonably large way. Copies were also sent to Townswomen's Guilds, Chambers of Commerce and all branches of associations affiliated with the member bodies of the N.I.C. Direct information was also given to inquiring members of the general public. Special value was placed on the participation of consumer interests in the work of the Council.

After a reference to the interest taken by the National Farmers' Union, the author said that the Council organised meetings in large provincial centres to which interested bodies were invited.

Relationships of the N.I.C. with the electricity supply authorities received attention in the next section. In this connection, Mr. Sutton said, the Council had produced a completion certificate which incorporated the basic information required by I.E.E. Regulation No. 510, with further specific details relating to tests, etc.

Dealing with approved contractors, Mr. Sutton said it was estimated that they were responsible for over 90 per cent of the electrical installation contracting work carried out in Great Britain. All approved contractors, irrespective of size or reputation, were treated alike. Although at first the Council was regarded with suspicion, experience of its operation had led to a better understanding. It was hoped to strengthen relations by organising meetings of approved contractors in various areas.

The next section of the paper dealt with the representation of and relations with the electrical manufacturers, the contractors, the I.E.E. and other professional and educational bodies and establishments.

Mr. Sutton claimed that there was abundant evidence that the Council's work was resulting in a definite improvement in the standard of installations. Under 0·2 per cent of the work inspected was "sub-standard" and over 95 per cent was satisfying the Council's requirements. As an indication of the extent of the work, he showed that in 1958 there were 3,179 routine inspections of approved contractors and 216 examinations of new applicants. Over 7,000 separate installations were inspected, largely in domestic premises, in which the work was supervised only by the contractors' staff.

Mr. Sutton concluded with a hope that all the authorities concerned with installation work would help to make the work of the Council known to the public.

"Lighting and the Common Weal"

WIDE VARIETY OF APPLICATIONS

YESTERDAY (Thursday) the morning session was devoted to a lecture-demonstration by Mr. O. W. Humphreys, C.B.E., M.I.E.E., on the theme indicated in the heading. Mr. Humphreys' approach to the subject was to consider the impact of lighting upon daily life, social habits, and living and working places. He discussed the question of colour, referring to the effects of discharge and tungsten lamps separately and in combination. A recent development was the experimental 1 kW (50,000 lumens) colour-corrected h.p.m.v. lamp which might transform the position; three of those lamps were at that moment lighting the Pavilion. He showed the effect of some recently developed phosphors and of the addition of zinc vapour to the discharge, filling in some of the gaps in the mercury spectrum.

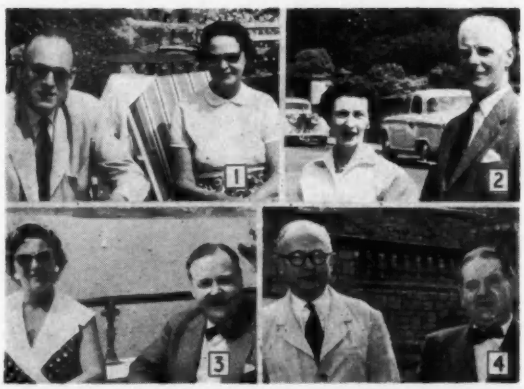
Mr. Humphreys went on to show how the cost of electric light had been progressively lowered by improved efficiency. He claimed that it was actually a cheaper substitute for daylight for the interior of buildings, owing to the saving in building costs. While the economic life of tungsten lamps was not likely to change very much, that of fluorescent lamps was such that it was becoming possible to box them up in inaccessible places in which they could remain until redecoration became necessary.

So far the fluorescent lamp had not made much headway in the home. Tungsten lamps had the advantage of compactness and they had been progressively reduced in size while efficiency had risen. In factories and commercial premises, however, the fluorescent lamp had made progress by reason of its efficiency and adaptability to the architecture of larger buildings. Mr. Humphreys discussed the ways in which the colour question had been tackled and the steps by which efficiency had been increased. He contended, however, that the highly-loaded tube had yet to prove its worth in this country where the 80 W lamp had put us in a more favourable position than the Americans, who generally used 40 W tubes. High illumination had to be carefully engineered and Mr. Humphreys showed the methods adopted to ensure freedom from glare. He demonstrated the examination of moving objects by means of the stroboscopic effect, colour-matching units and the illumination of various kinds of surfaces.

He then turned to "lighting at play," giving some information upon the illumination of football grounds, the use of lighting in theatres, cinemas and television studios, in film projection, *Son et Lumière*, etc.

Lighting in the field of transport was next considered, including street lighting. In this connection Mr. Humphreys mentioned the comparatively slow progress of the h.p.m.v. fluorescent lamp because of the general preference for the sodium vapour lamp, which was being further developed. He made mention of the lighting of tunnels as a special problem for the lighting engineer. Reference was also made to lighting on railways (particularly the London Underground) and at airports.

Finally, Mr. Humphreys spoke of lighting and architecture and showed how illumination could be combined with interior construction; he used as an example a model theatre. He also reminded his audience of the way in which the beauties of our finer public buildings could be revealed at night by the careful use of floodlighting. He ended by saying that he had not been able to touch on many other important aspects of lighting, which was an extremely wide subject.



1. Mr. and Mrs. R. H. Coates. 2. Mr. and Mrs. O. M. Robson. 3. Mr. and Mrs. M. Britton-Johnson. 4. Messrs. S. J. Addyman and J. R. Potts

The Trend of Invention

THE 76th report of the Comptroller-General of Patents, Designs and Trademarks has just been published by H.M. Stationery Office, price 1s 3d. It deals with the general business of the Patent Office for the year 1958. The report shows that in the electrical field development in printed circuits has continued, and there has been a marked increase in improvements in the qualities and stability of circuit components, particularly those of miniature size. During the year under review transistors were finding increasing application in computers, and maintaining circuits for mechanical oscillators such as tuning forks and telephone exchange circuits. Development of electronic telephone exchanges continued. Particular activity was shown in radar sets for aircraft using the Döppler effect to determine movement relative to the ground. Applications of analogue computers to machine tool control increased, interest being particularly directed to the production of a smoothly varying control signal from a succession of separate input signals. Considerable interest was shown in the use of photo-electric cells for counting and sizing particles and for controlling exposure in photographic printing. Increasing activity was apparent in the use of radioactive substances in measuring the physical properties of materials and for controlling industrial processes. There was a marked increase in the number of specifications relating to nuclear reactors, with particular reference to the construction and loading of fuel elements. Automatic machines were introduced for assembling electrical components and printed circuit boards. Development also took place in railway signalling for setting up safe routes through junctions with electrical interlocking.

New Books

The Structure of Metals: A Modern Conception. Published for the Institution of Metallurgists by Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Pp. 118; figs. Price 25s.

Since 1947 the Institution of Metallurgists has held an annual refresher course for its members, during which four leading authorities survey the present state of knowledge in relation to a particular aspect of metallurgy. Originally, these papers were republished in book form for Institution members, but the information they contained was considered too valuable for only a limited circulation. It was therefore arranged that all papers read at courses from 1956 onwards should be made available to a wider public.

The theme of the 1958 course was a review of some of the modern theories of the structure of metals. In the first paper Professor Raynor deals with developments over the past twenty to thirty years in the electron theory of metals, and concisely outlines modern concepts of this highly complex subject. Dr. Catterall, in the paper which follows, describes the experimental techniques which have been developed to test the theory and to establish such things as the width of the valence band, the shape of the "density of states" curves, the numbers and signs of charge carriers in electrical conduction, and the change of these properties with alloying.

Professor A. G. Quarrell discusses the dislocation theory of plastic deformation and, in the final paper, Dr. Nutting shows that this theory, at first received with some scepticism, has now been thoroughly justified by experiment, the techniques of which he describes.

Modern Electronic Components. By G. W. A. Dummer, M.B.E., M.I.E.E., Sen. Mem. I.R.E. Pp. 480; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Parker Street, Kingsway, London, W.C.2. Price 55s.

The author is head of components research, development and testing at the Royal Radar Establishment, and in addition to the work at present under review, he has written four more detailed books, on fixed and variable resistors, and on fixed and variable capacitors, with a fifth volume on wires, sleeving and r.f. cables to follow. The present work comprises an abridged version of this material, together with additional chapters on other components, including batteries and accumulators, but excluding electric motors, synchros, etc. Bibliographies at the ends of the chapters have been selected from the mass of available material to provide a brief but comprehensive survey of the literature of a subject which has not hitherto been covered in a single book. The references extend, with one later exception, up to late 1957.

This book will undoubtedly prove a useful reference work to a great number of those concerned with the design and specification of electronic equipment. Its scope extends even further, since the opening chapters cover a range of widely used component specifications; colour codes for resistors, capacitors, fuse links, laminations and sleeving; and conventional component symbols as laid down by B.S.I. and the I.E.C. A large part of the book—174 pages—is then taken up with the four classes of component previously mentioned, including outlines of the methods of production. There are very numerous illustrations, covering the general appearance of components, methods of construction and typical performance data, and representative of the products of a large number of manufacturers. Successive shorter chapters cover wires, sleeving and r.f. cables; plugs and sockets; relays; switches; the magnetic properties of various alloys and other materials available as laminations or cores, and transformers (excluding those for mains frequency operation); batteries, including water-activated and the newer secondary cells; and miscellaneous components.

The last part of the book—123 pages—contains an estimate of future developments in component design; operation at high temperatures, under tropical and arctic conditions, and at high altitude; highly miniaturised components for transistor circuits, and printed circuit systems; potting of components; the reliability of components, faults which may occur and testing methods and techniques.—P.L.D.

The Technical Writer. By J. W. Godfrey and G. Parr. Pp. 340; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 45s.

Until a few years ago there were only one or two recognised textbooks on technical authorship but in the last five years many books on the subject have been published, mainly in America. Very few, however, cover the complete art of authorship from the principles of good writing to the final production stages.

In this new book, the authors have assumed that the would-be writer is grounded in the principles of composition and requires mainly to avoid common pitfalls and to put a polish on his work. After discussing the technique of technical writing and the style and presentation, a complete chapter is devoted to the illustrations accompanying the text. There are many ways in which the text can often be clarified by the use of appropriate illustrations, which should always be regarded as an integral part of a technical paper.

The following chapters deal with printing processes, typography and editorial procedure. One of the points stressed is that familiarity with the process through which a manuscript must pass ensures that the finished product is as efficiently and neatly presented as is economically possible.

There are five useful appendices and among the details included are printers' and authors' proof correction marks, a glossary of terms used in printing and publishing, and a bibliography of literature on the presentation of technical information.

It will be found that this book forms a concise introduction to the new City and Guilds Course on technical authorship and it is the first book to include in one volume all the information required by a prospective technical author. It is highly recommended as a textbook and a reference book for practising authors, particularly for electrical engineers, since the examples are drawn from this field as it is the authors' home ground.—T.C.

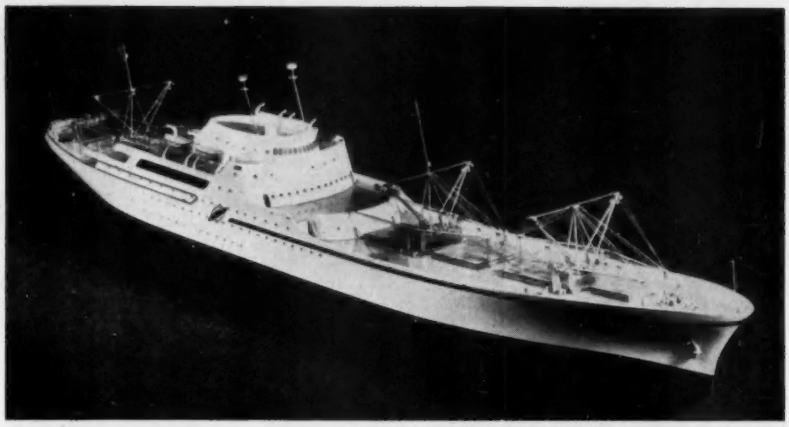
BOOKS RECEIVED

Semiconductor Abstracts. Volume IV. 1956 Issue. Compiled by the Battelle Memorial Institute. Pp. 456. John Wiley & Sons, Inc. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 96s.

Nuclear Power Plant. By E. Openshaw Taylor. Pp. 184; figs. 54. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 30s.

General Circuit Theory. By Gordon Newstead. Pp. 144. Methuen & Co., Ltd., 36, Essex Street, Strand, London, W.C.2. Price 15s.

The N.S. "Savannah"



Details of the world's first nuclear propelled merchant ship, the N.S. *Savannah*, and further details of the designs recently placed before the Admiralty

Nuclear Merchant Ships

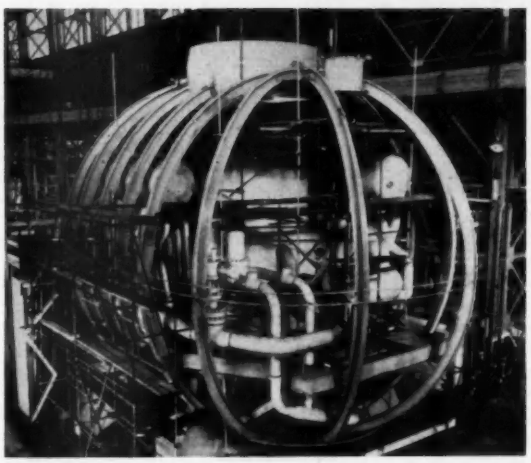
IN our issue of 15th May the eight different nuclear propulsion systems, which are being cosidered by the Admiralty for use in surface ships, were briefly reviewed. The design of the Babcock & Wilcox reactor plant submitted for consideration is basically similar to that now in an advanced state of construction by the Babcock & Wilcox Co. of America for the N.S. *Savannah*. The reactor is of the pressurised water type, ordinary water being used as the reactor coolant and also as the moderator of the fission process. This water is raised to a high temperature and pressure by absorption of heat from the reactor core and is circulated through the heat exchangers which generate steam to drive the conventional turbine propulsion machinery. The fuel used is enriched uranium and in the *Savannah* refuelling would take place only every 3½ years.

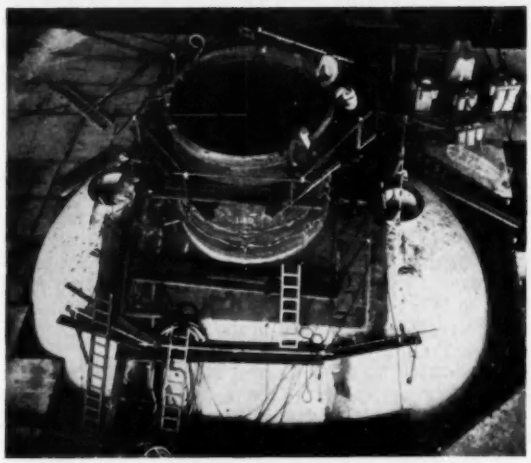
The Babcock & Wilcox Co. of America is supplying the reactor and heat exchangers for the *Savannah* and the De Laval Steam Turbine Co. the turbines. The maximum operational power output of the reactor is 69 MW (thermal) giving a design speed of 21 knots. The ship has a displacement of 21,840 tons with an overall length of 587ft 6in, a beam of 78ft and a draught of 31ft 6in. The single reactor drives a single screw via a turbine whose inlet steam conditions are 480 p.s.i. (saturated), 462·82 deg F. The containment vessel is 52ft 6in by 35ft diameter and the weight of the reactor, the containment vessel and the shielding amounts to approximately 2,500 tons.

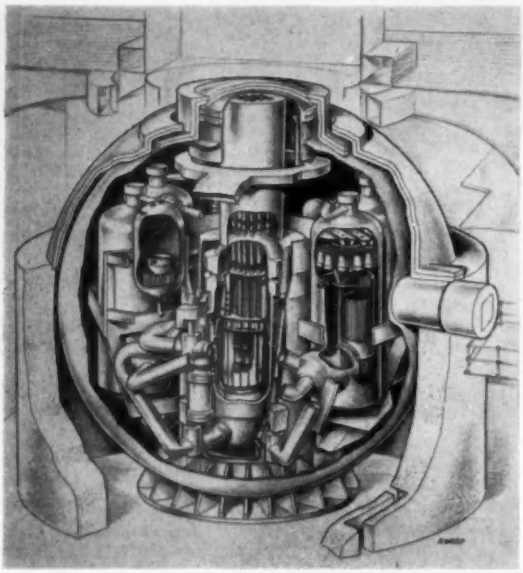
British Reactor

As already mentioned, the design of the reactor system submitted by the British Babcock & Wilcox company to the Admiralty is similar but is designed for an output two-and-a-half times as great as for that for the *Savannah* within only 20 per cent more space. The company states that the design and manufacture of the British system with the required output guaranteed is such that the vessel could be at sea by the end of 1962. The thermal output of the British reactor would be 180 MW with a fuel charge of enriched uranium dioxide of approximately nine tons. The containment vessel would measure

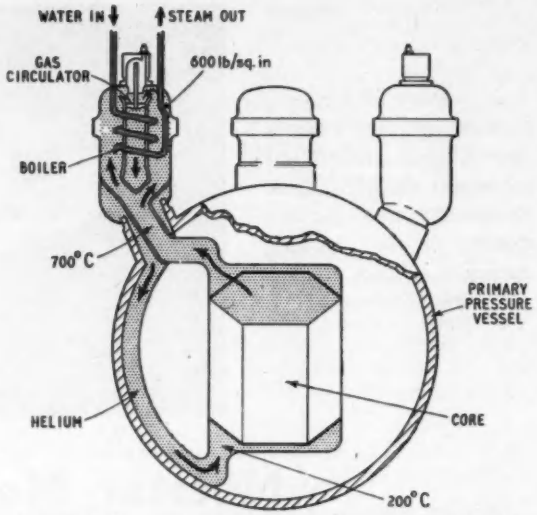
Left: Full-scale wooden model of the pressurised-water reactor plant designed by the Babcock & Wilcox Co. of America for the "Savannah" and (right) close-up view of the top of the reactor pressure vessel in position







Cut-away view of the pressurised-water reactor plant submitted to the Admiralty for consideration by Babcock & Wilcox, Ltd., for a British nuclear-powered merchant ship



Simplified diagram of the De Havilland marine HTGC reactor and boiler system. The core has a height of 6ft and an equivalent diameter of 6ft

42ft 6in in diameter and the weight of the plant would be approximately 3,000 tons, including the steam-raising units.

De Havilland HTGC Reactor

Further details were recently published of the high-temperature gas-cooled design submitted to the Admiralty by De Havilland. Two reactors, having a total weight of 2,400 tons, will be installed in a ship, giving a total heat output of 150 MW. The reactors will be able to operate independently and this feature represents a considerable safeguard in the event of failure of one unit. The fuel used in the reactor is a mixture of uranium 235 and thorium in ceramic form bonded into graphite pellets. These are contained in solid, impermeable graphite blocks which give additional neutron moderation. Helium gas at a pressure of 1,000 p.s.i., is pumped through the core and transfers the heat to six boiler units. The use of an all-ceramic core permits safe operation at temperatures in excess of 1,000 deg C. An estimate of the cost of the first production unit (less core fuel blocks) indicates a figure in the region of £1·4 million for a twin reactor installation.

E.T.U. Conference

THE annual delegate conference of the Electrical Trades Union opens next Monday at the Spa Royal Hall, Bridlington, and will continue throughout the week. It is expected that about 380 delegates will attend.

The agenda of 50 pages contains 184 motions, many of them carrying amendments. Of the 16 in the contracting section, only two deal with wages. The South Harrow Branch considers that the Executive Council should press the N.F.E.A. for a substantial pay increase, while Tunbridge Wells, " appreciating the difficulties met by our negotiators," asks that the Executive Council should press for the incorporation of the temporary hourly addition into the hourly basic rate.

A long motion from the Finchley Branch calls upon the Executive Council to implement the Union's rules more fully. It wants wider consultation with the membership before concluding wage agreements by calling a representative conference to consider the conclusion of any major agreements in the industry. A motion from from the Clapham Branch is concerned at the excessive overtime still being worked in the industry in " complete disregard of overtime permits."

In contrast, London Central No. 1 Branch wants a redundancy agreement to be negotiated which would provide for joint consultation between management and shop stewards before dismissal notices are given, dismissals to be discussed on the basis of the work available, a ban on overtime, and if redundancy is unavoidable, one week's compensation pay for members dismissed.

The 24 motions on electricity supply are a varied assortment. The " hardy annual " that sick and holiday payments and pensions should not be less favourable than for N.J.C. and N.J.B. grades comes from four branches. Sub-contracting is attacked in a motion from South Benfleet station engineers.

The Glasgow North West Branch detects a trend in the industry which sacrifices craftsmanship to technical qualifications. It considers that the efficient running of the industry is dependent on its being controlled by persons with practical experience. It appreciates that a certain number of persons with technical experience are essential, but finds that undertakings are being overloaded with certificated minor officials with no practical experience of the industry. Bourne Branch urges that the supply industry should be a closed shop.

As in the contracting industry, a further motion requests that modifications of existing agreements by the Executive Council, before being accepted, should first be submitted to a meeting of delegates from the five unions signatory to the agreements.

On internal affairs eight branches call for a Union sick pay scheme and one asks for a superannuation scheme.

Transistors and Semiconductor Devices

By I. G. CRESSELL, B.Sc., A.Inst.P., A.M.I.E.E.*

An International Convention on Transistors and Associated Devices was held at Earls Court, London, last week under the auspices of the Institution of Electrical Engineers. During the eleven years since the transistor was first introduced a great deal of research and development work has been conducted and striking advances have been made. The convention papers which are reviewed by the author form an excellent survey of the present state of the art

THE tenth anniversary of the discovery of the transistor by Bell Telephone Laboratories was celebrated in June, 1958. In a period of ten years, production of transistors in the U.S.A. has risen to an annual figure of 50 million, with a production of diodes nearly twice as great. In this country, comparable figures are four million transistors and six million diodes. Semiconducting devices have begun to make an appreciable impact on the production of receiving tubes, and it is estimated that by 1962 the annual production figures for tubes and transistors will be equal.

In contrast to the original applications of transistors in deaf aids and portable radio sets, a large-scale utilisation is beginning in the fields of data-handling and telephony systems, as the increasing reliability of the devices becomes apparent. Of ten major computers recently constructed in the U.S.A., seven are transistorised, and a steady penetration into control instrumentation is envisaged.

To meet the demands for manufacture and application of semiconductor devices, no fewer than eighteen commercial companies are engaged in this field in the United Kingdom alone, representing all the major heavy electrical, communications, telephony, and instrumentation concerns.

It is against this background of activity that the Institution of Electrical Engineers organised its International Convention on Transistors and Associated Devices at Earls Court, London, from 21st to 27th May. The importance of the subject was recognised by the presence of the Lord President of the Council, the Rt. Hon. the Viscount Hailsham, Q.C., who delivered the opening address, welcoming delegates from over twenty-five countries. The opening lectures by J. Bardeen, W. H. Brattain and W. B. Shockley, co-inventors of the transistor and Nobel prizewinners, traced the historical development of the subject, to which they have jointly made so great a contribution. The proceedings of the Convention are an eloquent testimony to the rich harvest which has resulted from post-war research stemming from original work on radar detectors in World War II.

The pattern of the Convention is one which post-war conferences have made familiar, with 150 papers fitted into six days by the mechanism of parallel sessions. Such a concentration of material tends to make the Convention severely specialist, but in a young and growing subject with a literature already extending to several thousand published papers, this seems unavoidable.

W. Shockley, in a brief, but characteristically stimulating lecture, discussed the principles of operation of the four-layer semiconductor diode. With the advent of diffusion techniques, high-frequency device operation is not primarily limited by transit time effects, since layers a few microns in thickness are practicable, but rather by lateral resistance of the control electrode. In the four-layer diode, where negative resistance arises from the interaction of avalanche effects with variable current gain, base resistance is still present, but a shunting resistance due to recombination in the space charge layer is present which tends to minimise its effect.

With a large-area device used for higher power operation, the four-layer diode may be represented as a number of negative resistances in parallel, and it seems probable that the efficiency over the area will not be uniform.

Dr. Shockley described two principles of operation for large-area n-p-n-p devices, impulsive charging, i.e. triggering the four-layer structure by fast pulses, and majority carrier extraction, the emitter being initially held in a reverse bias condition. The combination of these techniques may be used to ensure that the full area of the device is utilised.

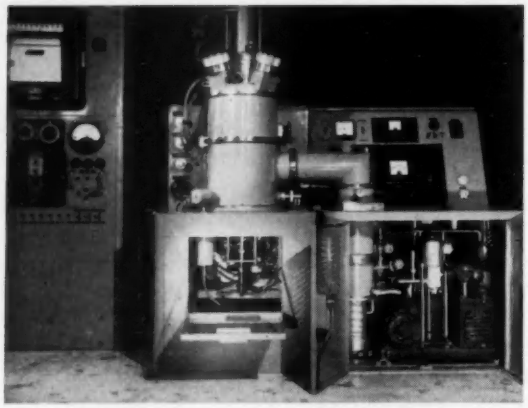
Materials

The predominant utilisation of germanium and silicon for transistors in spite of an intensive search for alternative materials, was reflected in the materials session of the Convention. As the scale of operations has increased, the need has become imperative to improve standards of control of the quality of semiconductor material itself, and of materials ancillary to its preparation.

In the case of germanium, purification techniques of zone melting and refining, as discussed by T. R. Scott of Standard Telecommunication Laboratories, are, in general, satisfactory. Economy of operation demands, however, that single crystals shall be grown even larger, and J. G. Wilkes, G.E.C., Wembley, described the production of five kilogram crystals with adequate quality control by vacuum crystal pulling.

Due to attack by silicon of the available silica crucibles, problems of crystal growth demand alternative approach, preferably using methods which dispense with the crucible altogether. The trend in this direction has led to the production of silicon in rod form by direct deposition from the vapour phase, followed by floating zone refining. In this method the molten zone is made to traverse repeatedly the rod silicon, held stable by surface tension, accumulating impurities by virtue of their enhanced solubility in the molten phase. To retain the advantages of the high purity material so obtained, it is desirable to be able both to grow single crystals by the same method

* Marconi's Wireless Telegraph Co., Ltd.



The growing of 5 kg single crystals of germanium

and to add suitable doping agents during this process. A contribution by J. Goorissen and A. van Run (Philips Research Laboratories, Holland) was representative of this technique, and discussed doping with phosphorus from the gas phase.

A compromise between floating zone and conventional pulling technique, namely growth from an electron bombardment heated pool of silicon in contact only with solid silicon, was described by D. Gasson (A.E.I. Research Laboratories, Aldermaston). It was shown that crystals with fewer than 10^{17} oxygen atoms/c.c. can be grown by this method.

For many specialist applications, the semiconducting compounds (binary and ternary) are of interest, and a technology is growing analogous to that of germanium and silicon. Professor Walker (Siemens Schuckertwerke, A.G., Erlangan), whose original work in this field is well known, described progress in the production of p-n junctions by crystal pulling, diffusion, or alloying, and the provision of ohmic contacts. In the thermo-electric power field, which is of growing importance, it was shown that the ternary compounds can be utilised to change advantageously the ratio of thermal conductivity to electron mobility.

Technology, Design and Manufacture of Semiconducting Devices

A comprehensive current review of devices has been given by R. G. Hibberd of the B.T.H. Co., Ltd. (I.E.E. Paper No. 2,914, May, 1959). A considerable diversity of function in commercially available devices is immediately evident from this paper, and in attempting to review the I.E.E. Convention, a selective approach must be made.

The position in the high-frequency low-power field was reviewed by R. James and W. M. Webster (R.C.A., Somerville, N.J.).

Present large-scale production is concentrated mainly on three basic types:—(a) Conventional alloy transistors, and their derivatives, the drift or graded base types; (b) surface barrier transistors, and their derivatives, micro-alloy diffused transistors; (c) mesa structure diffused transistors.

In all these types, every effort to secure application of mass-production techniques to reduce costs is being made. Present trends are to consider the drift transistor as having a value of f max. (the frequency at which the power gain is unity) under production conditions, of $\sim$ 30 Mc/s. Comparable figures given for surface barrier and MADT were 300 Mc/s and 500 Mc/s.

The search for a mass-produced transistor with very-high-frequency performance has led to the mesa structure, permitting the use of photolithographic techniques. The possibility of fabrication of 1,000 units on a single slice of semiconductor suggests that ultimately the mesa structure will be $\sim$ 75 to 90 per cent of the cost of the alloy transistor.

Dr. Anderson (W.E. Co., Allentown, Pennsylvania) underlined the findings of R. James and W. M. Webster, and suggested that a period of stability of device type will now ensue, in which consolidation of conventional alloy types under cost control will occur in the germanium alloy field. He anticipated that the unifying nature of diffusion processes of junction formation would lead ultimately to diffused silicon devices as the major product item in the low-power field.

Dr. S. L. Parsons (Lansdale Tube Co., Pennsylvania) detailed the development of large-scale techniques for the manufacture of surface barrier and micro-alloy diffused transistors. Automatic machines have been developed for etching, plating, electrode attachment, and other procedures, to provide a complete production line.

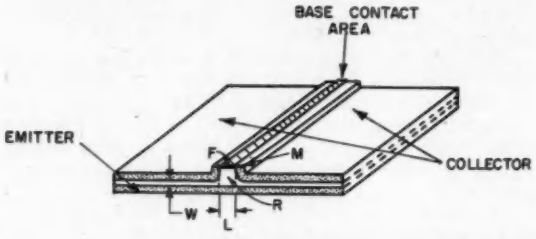
A further study of production costs in the transistor industry was made by S. O. Johnson (G.E., Syracuse, N.Y.). In his view, design flexibility, i.e. ability to cover a wide range of market demand with the minimum redesign and retooling costs, was an important consideration. He felt that the alloy-type transistor, while ranking high in market flexibility, rated low in reproducibility, and that the diffusion transistor, while rated higher in flexibility than either alloy or grown junction types, had a poor rating in terms of cost.

Once the photolithographic technique has been adopted for transistor fabrication, it seems logical to extend it further to include circuit elements in a unit package. A noteworthy contribution by T. H. Limatainen (Diamond Ordnance Fuse Laboratories) gave details of techniques of fabrication of transistors, diodes, resistors and capacitors by this method. Binary counter units 0·5in square have been successfully made, and component densities of $2{\cdot}5 \times 10^6$ per cu ft have been achieved.

Yields on diode matrices on single wafers ¼in square have been high; with electro-deposited and alloyed gold contacts, reverse currents of 2 μA at -10 V, with breakdown voltage 50 V have been observed, with 35 units serviceable out of a matrix of 36 units.

Final mounting is in hermetically sealed ceramic enclosures, which have successfully withstood 95 per cent humidity tests.

The flexibility of diffusion techniques was further illustrated in a paper by H. Nelson (R.C.A.) entitled "The Surface Immune Transistor." A combination of diffusion and precision lapping techniques is used to bring the base connection out centrally through the collector area, and has its principal application in the silicon power



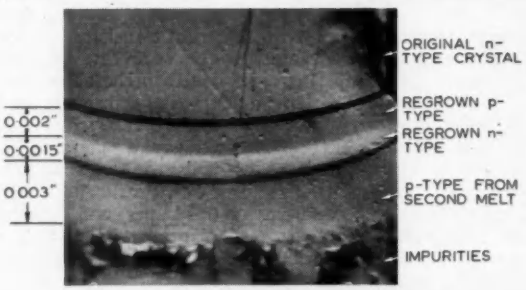
Surface immune transistor structure

transistor. The treatment of surfaces to ensure device stability remains one of the more obstinate problems of device production, in spite of considerable scientific progress in the understanding of the mechanisms of surface recombination. Any structure minimising the effect of surfaces will consequently have considerable importance in terms of device yield.

It is claimed that base current in the new configuration is inwards from the emitter and collector perimeters towards the central base lead, giving a forward biasing effect, crowding injection towards the central area of the transistor where no surface recombination can exist. Results presented by the author substantiated the basis of design, with additional advantages of a reduction in base and saturation resistances which is most valuable in a power structure.

The four-layer p-n-p-n structure, the solid state equivalent of the thyratron, is a relative newcomer to the family of solid state devices. Its potential applications for pulse generators, cross-bar switching, and general computer duties will hinge crucially on cost and reproducibility, and on the facility of trigger. On grounds of speed alone it has manifest advantages.

Of the several possible methods of production, Mr. Freestone (Siemens Edison Swan, Ltd.) chose to present



A method of preparing p-n-p-n switching devices

data on the "melt-back" technique applied to germanium. The technique used gave yields of 80 per cent in terms of finished devices, with a relatively straightforward procedure.

A more sophisticated paper was introduced by H. Lowry (G.E., U.S.A.) entitled "Industrial Applications of Silicon Controlled Rectifiers." The subject matter of this paper represents the fulfilment of many early prophesies that semiconductors would invade the field of high current engineering, in its control aspects, just as they have already made an impact in high current rectifiers. Commercially available units, using the p-n-p-n silicon structure, can block voltages of either polarity up to 300 V, and may be triggered to the high conduction condition by 50 mA at 2 V applied to the gate lead. The forward drop in the "on" state may be as low as 2 V at 500 A. As a consequence units with continuous ratings of 16 and 50 A have been made possible, with surge ratings a factor ten higher.

The silicon controlled rectifier is found to be competitive in cost with thyratron or magnetic amplifier systems when used as a phase shift controlled a.c. switch. It may be applied to d.c. motor control, d.c./a.c. invertors, and speed control of a.c. motors. This device is undoubtedly a powerful challenge to the ingenuity of the circuit designer.

The term "design" in its engineering sense usually means design for manufacture, it being assumed that basic principles are fully established. As semiconductor devices drive towards higher current densities of operation, and higher switching speeds utilising avalanche mechanisms, the basic scientific assumptions become increasingly more dubious in their validity, and design becomes a semi-empirical procedure. The re-examination and extension of basic theory of devices are reflected by a number of papers presented at the Convention.

The limits of application of the Boltzmann equation to junction devices were discussed by A. C. Sim (S.T.C.), and it was suggested that only qualitative data may be obtained by application of standard theory. An extensive treatment given by J. Shields (B.T.H. Co., Ltd.) of the high current forward characteristic of the p-n-n+ diode indicates that in this context the picture is a little less gloomy. It was concluded that the effects of non-linear or multi-level recombination will cause only small refinements of the general theory.

Dr. Gibson (R.R.E., Malvern) discussed the design of n-type germanium avalanche diodes, with switching times in the millimicrosecond range. It was concluded that an adequate theory for the trigger voltage and current, in terms of resistivity, junction radius and temperature could be obtained which gave reasonable agreement with experiment.

An understanding of the recombination of excess carriers is basic to the functioning of semiconducting devices. In transistors and high current rectifiers, low body recombination is essential to efficient transport of injected carriers, whereas in switching diodes, charge storage times must be minimised, and high recombination rates are desirable. Research is therefore being directed in two opposite directions, namely, to obtain means of controlling the incidence of avoidable recombination, with a view to increasing body lifetime, or, alternatively, to find dominant recombination mechanisms, so that they may be systematically increased to control hole storage.

A comprehensive review by P. Landsberg (University of Aberdeen) indicated the complexity and diversity of the recombination mechanisms under study. Even in the case of germanium, where high crystallographic perfection and purity are attainable, copper, manganese, iron, potassium and lattice defects of various types, possibly interacting with the elemental impurities, and existing in various stages of precipitation, may be expected to play a part in recombination.

The quenching and heat treatment of silicon, and the role of oxygen in the observed behaviour of recombination, are important in device fabrication in view of the relatively high temperatures used for alloying and diffusion operations.

Quenching from high temperature of silicon diodes, and its effect on device performance, was discussed by M. Calle, B. Dale and C. Foxell (G.E.C., Wembley). The reduction in body lifetime was shown to deteriorate the forward characteristic, and result in increased reverse current. Subject to these reservations, charge storage was materially reduced by 1,150 deg C heat treatment. An alternative method used mentions bombardment to provide radiation damage, a method successful when applied to finished diodes but not when applied to the silicon material. It was suggested that the radiation damage annealed out during the diode alloying process at 750 deg C. It was further observed that long-term annealing on the canned diodes occurred at low temperature, analogous to similar effects previously observed after electron bombardment.

Transistor Applications—Line Communications

In the field of line communications, the transistor has perhaps to meet the most exacting tests of its reliability

since the device life required is considerably higher than is expected in normal applications.

Dr. Tillman (P.O. Research Station) reviewed the situation obtaining in multi-channel telephony. In modern systems, improved channel separation using efficient filters, low-loss and highly uniform cables, suppression of intermodulation products and gain stabilisation by negative feedback have resulted in considerable progress. The transistor has to compete for reliability with special valves, where field experience has yet to substantiate the comparative life figures required, and much remains to be done in establishing negative feedback circuit configurations for line amplifiers.

It was suggested that in pulse code modulation, the ease of coding, using transistors, relative to the cumbersome nature of thermionic valve coding methods, is permitting some advances. Older cables installed before carrier telephony became universal, may well have their capacity increased with P.C.M. working. It was forecast that long-distance digital information transmission would entail a big increase in the uti isation of transistors.

The determination of "life" transistors has always presented difficulties, both of definition and of measurement. With improvements in device processing and encapsulation, including pre-baking and ageing by the manufacturer, the task of the equipment designer in the evaluation of equipment failure rates has become expensive and prolonged.

F. F. Roberts, J. C. Henderson and R. A. Hastie (P.O. Engineering Department) discussed measurements of accelerated life tests on transistors, using junction temperatures in the range 50 to 100 deg C. Such acceleration, where its validity can be established, permits the equipment designer to make comparative measurements of transistor types, prior to equipment development, and is hence of considerable importance. The authors conclude that in the range of temperatures studied, the life of the transistors is reduced by 50 per cent for each 6 deg C rise in junction temperature, and that higher collector voltages result in shorter mean life.

J. Barry and F. Nixon (G.E.C., Wembley) detailed both the design and reliability of a pulse-amplitude-modulation system for electronic exchanges, operating at 10 kc/s p.r.f. They used transistors conforming to Post Office specification, type P.O.3, and found an equipment failure rate of 1·7 per cent per thousand hours. These figures confirm that for telephonic applications a greater degree of reliability is called for, and represent a challenge to the transistor manufacturer.

Solar batteries for use as the power source of unattended u.h.f. repeaters

At the present time, the introduction of electronic techniques into automatic telephone exchanges is a topic of particular significance and the advance of solid-state devices adds much to design possibilities. The problems involved were reviewed by H. K. M. Crosser (N.V. Philips Telecommunicatione Industrie). It was suggested that an analysis of the cross-point will dominate overall design, and give an indication of the desirable choice of either fully electronic or mixed electronic-mechanical systems, and between time or space division of speech-path network.

The introduction of the p-n-p-n four-layer switch appears to offer a most suitable cross-point element, satisfying both the transmission and switching requirements in a single component. The p-n-p-n switch, being available as both a diode and triode, permits a variety of methods of control.

The use of conventional transistors operating under avalanche conditions for the production of millimicrosecond pulses is a relatively recent technique. The analysis of this mode of operation, involving high level, non-linear conditions, is complex. J. L. Moll (Stanford University) discussed the treatment using stored charge as the variable. The depletion region of n-p-n germanium transistors is extended to within 3 microns of the emitter junction to obtain pulses in the millimicrosecond region.

The design of avalanche transistor trigger circuits was discussed by G. B. Chapman and A. R. Owens (U.K.A.E.A.). The transistors used for this purpose were normal medium-frequency units. A low selection rate was found for normal commercial transistors and in view of the spatial tolerances it would seem that diffusion transistors might give better figures than the alloy type.

Two papers dealt with the properties of transistors used as bi-directional switches. The first paper, by J. Evans, D. Ridler and R. Scarr (S.T.L., Ltd.), gave a general introduction to the behaviour of the device, and comparisons of d.c. and switching characteristics. Practical applications formed the second part of this paper, and detailed the basic bi-directional gate, a balanced modification, a magnetic drum-head switch, and an electronic-telephone multiplex switching network. Transistors in the multiplex system are pulsed for 2 microseconds at 100 microsecond intervals, and carry peak charge transfer currents of 200 milliamperes. The economics of components introduced by multiplex operation can lead to a reduction in the number of switching elements by a factor 10 compared with a mechanical exchange.

The second paper, by G. Ord and P. L. Lewis (R.R.E.), dealt with the combination of a 60 millimicrosecond delay line and a one-digit store which, if used with a bi-directional switch, may be used for transfer operations in about 200 millimicroseconds.

The treatment of transistor switching parameters may be simplified in its presentation by using the concept of charge control, which can provide a useful link between transistor specification and circuit design. R. Beaufoy (British Telephone Research, Ltd.) gave a lucid exposition of this technique, with a companion paper by J. J. Sparkes on "Measurement of Transistor Transient Switching Parameters."

General Applications

Amongst the wide range of applications presented at the Convention, it was perhaps surprising that the airborne communications field received scant attention. A description by W. T. Eastwood (Marconi's W.T. Co.) of a transistorised airborne teleprinter receiver for the North Atlantic route gave an indication of the trend in design. The receiver, operating in the l.f. band between 90 and 150 kc/s, operates at keying speeds up to 66 words/min and frequency shifts of 40-60 cycles. Four spot crystal controlled frequencies are available to give adequate

narrow band stability. It was suggested that such automatic teleprinter information could be used to convey meteorological information, and free the congested h.f. communication channels, in addition to reducing the load on the operator.

The receiver weighs less than 9 lb, and has a volume on the operator.

The complexities of modern science were reflected in a paper by R. C. Bowes and J. C. Gill (R.R.E., Malvern). The efficient use of computers for experimental results demands that experimental information shall be recorded directly in digital form, since transfer from analogue to digital data may take longer than the computer processing time and initial recording. The authors described an all-transistor digital voltmeter, primarily intended for use in automatic measurement of Hall effect in semiconductors, but obviously of wider application. Voltages up to 10·23 mV are displayed as a ten-digit binary number of 10 microvolt steps. Both visual and tape punch outputs are provided. As is usual in this type of equipment, display lights consume twice as much power as the equipment itself.

The use of semiconductors in artificial satellites to provide solar batteries has received widespread publicity. Inhabitants of the United Kingdom are, however, frequently sceptical of this application in our climate. M. Kobashi, Y. Ishikawa and K. Hayashi (Nippon Electric Co., Ltd., Japan) described the use of solar batteries on Mount Shinobu, which has a long rainy season, as a source of power for unattended u.h.f. repeaters. A design figure of 70 W maximum power output was aimed at, with nickel cadmium batteries used for standby duty. No fewer than 4,320 solar batteries were stacked to provide power supplies to transistors, valve heaters and valve anodes. The authors are satisfied that the impregnation of the silicon solar batteries in acryl resin is adequate to withstand the severe climatic conditions encountered on the mountain top, and that the units could operate reliably over a period of several years.

At the conclusion of the technical proceedings delegates attended the Convention dinner at the Connaught Rooms. The importance of the social aspects of an international gathering of this type had not escaped the organising committee, and it is to be hoped that international co-operation between the various laboratories has been materially aided.

Acknowledgment is due to the Institution of Electrical Engineers for the loan of the illustrations.

N.P.L. OPEN DAYS

EXHIBITS showing a selection of recent achievements and regular day-to-day work were on display during the two open days at the National Physical Laboratory at Teddington, Middlesex, on 27th and 28th May. Each of the nine Divisions of the Laboratory had selected major topics of interest for display to representatives of industry, scientific and educational organisations and the Press.

At the request of the Atomic Energy Authority, the Applied Physics Division of the Laboratory has undertaken to provide a service for the calibration of neutron sources which are required to provide accurately known and reproducible neutron fluxes used to determine parameters of great value in reactor design. On view were shielding and remote handling facilities for the storage and manipulation of sources, with equipment for comparing neutron source strengths. Also being undertaken for the Authority was an investigation being carried out in the high voltage laboratory on the suitability of available high voltage capacitors for the production of repeated high current discharges. In the short circuit tests on these capacitors, which particularly examine the mechanical strength of the internal connections, a concentric discharge gap of minimum inductance suitable for the rated voltage is set up around the capacitor terminal. At a lower voltage an oscillograph of the discharge current is taken, the Q factor and ringing frequency obtained, and circuit inductance, resistance and peak current derived. The capacitance and power factor are measured before and after 100 discharges at the rated voltage. The current from a low inductance 0·5 μF capacitor at 100 kV is about 100 kA. The life test consists of discharging the capacitor a specified number of times, which may be up to a million or until a failure occurs, at ten second intervals into a circuit of specified frequency and Q related to the intended use. The frequency is lower than in the short circuit test. This test examines the behaviour of the dielectric material and the capacitor assembly as a whole under prolonged repeated stressing. A precision voltage amplifier having an amplification ratio up to 1,000 : 1 with an accuracy of 0·01 per cent and wire wound resistors of high value up to 1,000 MΩ were also exhibited by the Applied Physics Division.

Exhibits in the Basic Physics Division included an estimation of thermal conductivity from electrical resistivity measurements for titanium alloys and high-nickel alloys, and new equipment for the measurement of the pressure-volume-temperature relationship of gases by the variable volume piezometer method. A new technique has been developed for spectroscopy at wavelengths in the far infra-red region, in which observations are made with an interferometer and the spectrum is derived by making a Fourier transformation using a high-speed digital computer. The improved spectroscopy in this region promises to be valuable in the study of intermolecular forces, superconductivity and other solid state physics problems.

Creep Testing

Electrical strain recording apparatus for creep testing was shown by the Metallurgy Division. Creep deformations, which normally range from 0·00002in up to 0·2in and above, are detected in a test piece with a high temperature extensometer and the movements converted into changes of mutual inductance by a linear differential transformer in which an iron core moves relative to a primary and two secondary windings. The secondary windings form part of a bridge and the changes of resistance needed to obtain balance are a measure of the movements detected. The bridge is energised from a 50 c/s a.c. supply which enables automatic balancing to be obtained with a slide wire resistance driven by a conventional servo motor.

In the Light Division, work has been carried out on the application of moiré fringes to linear measurements and machine control using diffraction gratings as accurate scales, a long measuring grating being traversed by a short index grating of the same spacing, the relative movement resulting in a succession of moiré fringes observed by a photocell and recorded electrically. A similar system is used for the accurate measurement of angles using radial

gratings. An important application of these methods is the control of machine tools. In a screw-cutting lathe, for example, an accurate relationship must be maintained between the linear traverse of the cutting tool and the rotation of the work. Errors arising in the gearing and lead screw can be minimised by fitting a linear grating system to the tool saddle and a radial system to the lathe head stock, electrical signals from each system being kept in constant phase relationship by a servo system. Among the apparatus on view in the Standards Division was equipment for determining the gyromagnetic ratio of the proton by measurement of precession frequency in a weak magnetic field, and equipment for precise inter-comparisons of wavelengths of lines in atomic spectra using a pressure-scanning Fabry-Perot interferometer and photo-electric recording.

Why the T.V.A. Ordered from Parsons

EARLIER this year C. A. Parsons & Co., Ltd., obtained an order worth over $12 million from the Tennessee Valley Authority for a 500 MW turbo-alternator for the Colbert steam plant near Tuscumbia, Alabama. It will be recalled that shortly before the order was placed pressure from American manufacturers had led the U.S. Corps of Engineers to reject the tender (previously accepted) of the English Electric Co. for turbines for the Greer's Ferry project. The T.V.A., as reported at the time, were subjected to similar pressures to buy from an American firm, on the grounds of national security and employment, but they refused to alter their decision.

In a statement of their reasons for ordering this particular set from Parsons (the full text of which we have recently received), the T.V.A. say that the purchase, made under the competitive bidding procedures required by the T.V.A. Act, was based on four considerations. (1) The evaluated Parsons bid was more than $6 million lower than the tenders of the Westinghouse Electric Corporation and the General Electric. (2) Full compliance with the provisions of the Buy American Act and established national policy on foreign purchases. (3) A determination that Parsons is qualified and adequately equipped to build and deliver the turbo-alternator on schedule. (4) Assurance that Parsons is able to provide promptly any repair service and replacement parts.

The T.V.A. say that they were led to invite bids from foreign manufacturers by the rising prices of the three American firms which manufacture large turbo-alternators. Since 1951 these had increased by 50 per cent compared with the average rise in wholesale prices of 5 per cent.

When the three bids received were evaluated by the T.V.A. for efficiency and escalation, the two American companies' prices were found to be nearly 50 per cent higher than that of Parsons. Moreover, Parsons were the only company willing to accept a contract containing the provision specified in the invitation for payment of damages in the event of delay in delivery. This the T.V.A. considered of great importance because of the substantial additional costs they have incurred in recent years due to the late delivery of generating sets. In the T.V.A.'s invitation to bid American manufacturers were given a price advantage of 20 per cent, or $2·6 million based on the Parsons evaluated bid. In addition, Parsons will have to pay import duty amounting to $1·5, plus trans-ocean shipping and marine insurance.

Rejecting the suggestion that American manufacturers are unable to meet foreign competition because of the difference in wages paid in the United States and abroad, the T.V.A. say that, based on the manufacturers' own estimates for the man-hours involved in building the turbo-generator, the labour costs would be about $1·5 million. This does not allow for any greater efficiency in the larger United States plants. It appears, therefore, that the import duty is adequate to protect American manufacturers against differences in labour costs. Fears that competition by foreign firms will result in all or most large turbo-generators being manufactured abroad, thereby eliminating American productive capacity as a supply source in defence emergencies, are unfounded. The total capacity for producing such equipment is so limited that all of it, both in Europe and the United States, will normally be required for meeting world demands for electrical energy.

In the event of war the problem of repair or replacement would be about the same whether the turbo-generator had been manufactured in the United States or abroad. The addition of a Parsons unit to the T.V.A. network increases the number of suppliers who can be called on in the event of an emergency and thereby reduces the risk of delay in getting the maximum capacity back into service.

The economical operation of the T.V.A. power system, to which the saving of more than $6 million contributes, is important in the national defence budget, since half the power from the T.V.A. installations goes to defence installations. The introduction of real price competition among turbo-alternator manufacturers makes a contribution to combating inflation. At the same time purchase of the unit from Britain strengthens our ally's economic position. Since the dollars which go to Britain will eventually be used for the purchase of American goods the T.V.A. consider there will be a net benefit to American labour. They also point out that the saving on this order affects T.V.A.'s ability to provide low-cost power. This will stimulate industrial activity and employment and enable the domestic consumers in their area to continue to provide the best market in the United States for electrical appliances. The money the T.V.A. invests in generating plant is exceeded by purchases by consumers of electrical appliances and equipment—more than $2 billion worth since the end of the war—of which General Electric and Westinghouse are the leading suppliers.

I.E.S. Golden Jubilee

TO enable overseas members to participate in its golden jubilee, the Illuminating Engineering Society has arranged a three-day series of visits to places and installations of interest in and around the London area to take place from 11th to 13th June, and 95 visitors from 21 countries will be taking part. Visits will be made to Gatwick Airport, Crawley New Town, the B.B.C. television studios, new TV Centre, the G.E.C. Research Laboratories, the Houses af Parliament, the T.U.C. building and to Thorn House, which is now nearing completion. After dinner on the second day at the Houses of Parliament the party will embark on a launch to see the floodlighting of London from the Thames. The series of visits will conclude with lunch at the Tallow Chandlers' Hall in the City.

INSTRUMENTATION AND COMPUTATION

At a symposium which was held in London last month instrumentation and computation in process development and plant design was discussed in some 18 papers. The topics covered included the improvement of process efficiency, process control systems, and the applications of various types of computers. About 500 people from many different countries attended and the papers, which are reviewed in this article, emanated not only from the United Kingdom but also from the United States, Russia and Holland

ORGANISED by a committee formed by the Institution of Chemical Engineers, the Society of Instrument Technology and the British Computer Society, a joint symposium on instrumentation and computation in process development and plant design was held at the Central Hall, Westminster, from 11th to 13th May under the ægis of the British Conference on Automation and Computation.

The first session, under the chairmanship of Mr. W. K. Hutchinson, representing the Institution of Chemical Engineers, was devoted to the improvement of process efficiency. Four papers were presented, the first being "Statistical Considerations in Process Optimisation" by Mr. G. A. Coutie (I.C.I.). Since most chemical processes are complex, methods of improving efficiencies often have to be entirely empirical. Mr. Coutie described statistical methods for separating real effects due to small deliberate changes in process conditions from random errors. A type of "evolutionary operation" was described which had been successfully applied to production processes. This operation was based on the application of small changes to operating conditions over very long periods to obtain a guide for giving optimum efficiency. The I.C.I. Dyestuffs Division had some 40 processes operating in this way.

"On the Optimal Control of Chemical and Petroleum Processes" was the title of a paper by Messrs. R. E. Kalman, L. Papidus and E. Shaperio. This paper was entirely American and described in detail the basic concepts of performance optimisation of chemical reactions by means of a computer-operated control system.

The third paper was an Anglo-American effort prepared by Mr. B. D. Hainsworth, Professor J. B. Reswick, Mr. J. J. Florentin and Dr. J. A. Westcott. They dealt with the correlation analysis of a heat exchanger and covered the statistical analysis of typical heat exchanger records. Two techniques were described, one of which leads to the frequency response and the other to the time response. Messrs. J. M. Keating and D. S. Townend then presented a paper on superfractionator controllability data obtained by the use of a digital computer. Steady-state relationships between the independent variables and the product quality had been calculated on a digital computer over a limited range for a superfractionator column. The resultant graphs would be used as tools in the study of plant flexibility and in evaluating and analysing proposed control systems.

In opening the discussion on these papers Mr. Hainsworth pleaded for authors to reduce the terminology to everyday language and avoid where possible the use of new terms. He asked authors to state what they were doing, how they were doing it and the conclusions they reached, very clearly. Mr. Hainsworth commented that the papers generally suggested that more accurate instrumentation was required than was commercially available to accommodate such techniques as evolutionary operation.

Mr. E. D. Dagnall emphasised the fact that none of the papers mentioned the economic aspect of automatic control particularly as applied to computer control. Commenting on the correlation analysis of a heat exchanger, Dr. H. H. Rosenbrock spoke of the practical difficulties of applying either step or frequency response tests to actual plant. He said that the paper by Messrs. Keating and Townend illustrated clearly the different approach to the design problem which must be made by process engineers as opposed to servo-mechanism designers. In discussing the paper on the optimal control of chemical processes Mr. Weiner said that, if used, a computer should control direct and not merely be used to reset existing conventional controllers. He also suggested a "packaged unit" computer to facilitate the application of small digital computers to process control.

Process Control Systems

Mr. J. S. Brough, representing the British Conference on Automation and Computation, took the chair for the second session of the symposium. The first paper, by Mr. J. E. Samson, described the use of an analogue computer to study the control problem of axial flow compressors. As a result of the analogue studies special control equipment was developed.

For accurate blending operations accurate flow-measuring devices are needed. Most commercial differential pressure equipment has an accuracy of 2 to 3 per cent, which is not acceptable, and in a paper on ratio flow controllers for in-line blending Mr. H. H. Idzerda described a control system based on positive displacement meters having an accuracy of ratio of 0·1 per cent. This system has been in practical operation for over a year.

Mr. C. J. Lyon presented a paper on design methods for dual-temperature chemical exchanger processes for the production of deuterium. The physical data and mass transfer equations being known, the equations had been programmed for an electronic digital computer so that the effects of different process conditions could be compared and an optimum set chosen.

The final paper of the session, by Messrs. E. Muller and D. C. F. Pratt, was the case history of the design and operation of a section of the chemical plant concerned and the maintenance of the volume and concentration of a circulating caustic soda solution.

When he opened the discussion Mr. Townend said that the approach to the control problem as described by Mr. Samson was the exception rather than the rule. It was a pity that more design could not be achieved in

this manner. Dr. Rosenbrock mentioned that the basic idea used by Mr. Idzerda had been Clerk Maxwell's, but until now it had never been successfully applied.

The application of in-line computers was dealt with in the third session under the chairmanship of Mr. T. E. Goldup, representing the British Conference on Automation and Computation. Mr. W. H. Jenkins, in a paper on the application of control and information handling to rolling mills, presented a survey of the current methods of operation of slabbing and strip mills including the present-day applications of automatic control and the possibilities and scope of future applications of automatic control.

A data processing machine for nuclear furnace protection was the subject of a paper by Messrs. J. L. W. Churchill and R. S. Hopkins. They described the method of measuring the radioactivity of the coolant gas in a gas-cooled nuclear reactor, the statistical methods of setting danger levels to operate alarms and the methods of storage in a special computer. The equipment described was for Berkeley power station.

A simple electrical analogue computing device based on force balance transducer principles was described in a paper by Mr. R. J. Redding. The speed control of four independent shaft speeds to better than 0·25 per cent by the combined use of analogue and digital methods was the basis of a paper by Mr. M. W. Sage. It was necessary for this system to operate over a 5:1 speed range of all shafts.

In the discussion which followed these papers Mr. A. Issac compared electrical and pneumatic control; electrical control in Mr. Redding's paper gave a range of regulation of 5:1 with an accuracy of 1·5 per cent whereas in the paper by Mr. Samson, on pneumatic equipment, the range of regulation was 15:1 with an accuracy of 1 per cent and 250:1 with an accuracy of 2 per cent. Dr. Westcott referred to the financial loss which had been incurred during the construction of several nuclear power stations and asked for more co-operation between the user and the supplier to share this type of loss as the cost of experience which was essential for further development.

Analogue Computers

The afternoon of the second day of the symposium (chairman, Dr. M. V. Wilkes, president of the British Computer Society) was devoted to the design and use of analogue computers.

An analogue computer for economic estimation and assessment of construction, development, and other projects, was described by Dr. D. W. Gillings. The design of a prototype computer was outlined and its operation illustrated with examples which were also worked out without its aid for comparison. The example given was that of a number of simplified schemes for power station extensions. Comparisons were made to show the effect of various times of installation of plant, choices to meet expected demands, and the small changes in realisation rates.

A short paper, by Mr. P. N. Kopai-Gora from Moscow, described a digital computer for the investigation of some aspects of the cold steel mill rolling process.

The final paper of the second day, by Messrs. J. E. Rijnsdorp and A. Maarleveld, dealt with the use of electrical analogues in the study of the dynamic behaviour and control of distillation columns. Electronic analogues were constructed to study column control and about 25 operational amplifiers were used. The paper discussed the theory of dynamic behaviour and the construction of the analogue.

Mr. J. F. Coales, president of the Society of Instrument Technology, was chairman of the closing session when two papers were presented on the use of computer techniques in large and small companies. The organisation of a computer-aided design department was described by Mr. R. W. Sargent who outlined the general characteristics of computers as they affected the formulation of problems. An illustration of programming procedure was presented, and the need for standardisation in programme techniques and the presentation of data and results was discussed. The different types of problems handled by a design department were then considered. A paper by Mr. S. T. Lunt outlined some possible organisations, discussed the cost of computer services and suggested some ways in which the smaller units of industry might be served.

The closing paper discussed "The Future" and was presented by Sir Harold Hartley. Commencing with a review of present-day trends, Sir Harold said that control engineering would be recognised as a primary technology since control theory was becoming more and more indispensable. There had been more progress in theory than in practice and this gap must not become too large. Sir Harold appealed for more co-ordination between the mathematician and the physicist. It was estimated that in three years' time we should see computers ten times faster than at present and in the future speeds over 100 times faster would be achieved. The increased speeds together with fast storage and increased logic would do much to increase the possibilities of the digital computer. Comment was made on the need for training instrument maintenance engineers and also on the fact that control techniques were more advanced than measuring techniques.

Education and Careers

AT the Education and Careers Exhibition held at Olympia which closes today (Friday) an "Education in Industry" feature links the two main parts of the exhibition, education and careers, showing the importance given to education and training in the programme of many of the major societies, firms and undertakings, including the British Transport Commission, the British Iron and Steel Federation and the General Post Office. Three members of the Scientific Instrument Manufacturers' Association, Baird & Tatlock (London), Ltd., the Coventry Gauge & Tool Co., Ltd., and Hilger & Watts, Ltd., have collaborated on a stand in this section showing the opportunities for careers in the instrument making industry.

The careers section is intended to give school leavers and their parents an idea of the wide scope of careers and opportunities open to young people either on leaving school or after a further period of full-time education. Among the stands in this section is an exhibit by the Engineering and Allied Employers' National Federation in collaboration with the British Electrical and Allied Manufacturers' Association, the British Engineers' Association, the Association of British Aircraft Constructors, and the Society of Motor Manufacturers and Traders showing the opportunities in the wide field of engineering and displaying some of the industry's achievements.

The Central Electricity Generating Board's stand features craft and student apprentice training, apprentices demonstrating the tasks performed during their basic workshop training. A model of one of the new nuclear power stations under construction is shown, with another depicting a present-day transformer station, while part of the stand represents the Board's research laboratories. Among the company stands is that of International Computers & Tabulators, Ltd., where opportunities in the manufacture and distribution of data processing equipment are illustrated.

VIEWS on the NEWS

By REFLECTOR

SOME years ago, I remember, telegraph and telephone authorities in some of the more primitive countries were much embarrassed by the depredations of the natives on their lines, copper wire being in great demand for personal adornment. I was reminded of this by reading a report in the *Morning Advertiser* that Yorkshire Electricity Board engineers had found that more than a mile of overhead line, weighing about a ton, was missing between Gowdall and Hensall, near Selby. In this case, of course, the thieves' motive was profit, not personal adornment.

* * *

The *Manchester Guardian* reports that the National Coal Board is not to use oil to generate electricity to light its coal mines. The occasion of this disclaimer was a protest by members of the National Union of Mineworkers against a supposed decision of the Board to light four pits in the Staveley area by "oil-generated electricity." Apparently there was some misunderstanding for an N.C.B. spokesman said:—

> "Any electrification plan we have would involve the use of power from the national grid—and that is supplied mainly from power stations which burn coal."

The Board should inquire which stations are feeding their part of the grid to make sure that there are no mistakes.

* * *

The South Western Electricity Board must be using a strange kind of "utility" distribution gear if the following paragraph from a letter in the *Western Times* is any sort of guide:—

> "No mention is made, however, of the weird-looking 'Heath Robinson' contraptions which mysteriously and increasingly appear in various odd corners of urban districts. I believe they are called transformers or substations, but little attempt is made to hide or camouflage the untidy mass of springs and wires of which they are composed."

* * *

A Russian writer of children's stories, Kornei Tchoukovsky, has recently published a book of reminiscences entitled "From Two to Five" in which he refers to advances in the juvenile Russian's technical vocabulary. He quotes a child of four (the son of a writer, not of an engineer), saying to his mother: "Mother, today I'm as tired as a 120-volt bulb working on a 220-volt current without a transformer." I have heard much of the tremendous drive for technological education in Russia but I had no idea that it began in the kindergarten.

* * *

Amid all the troubles that occur on the Eire-Ulster border it is pleasant to know that electricity forms a bond between the two parts of Ireland. Replying to a question in the Northern Ireland Parliament the other day, Lord Glentoran, the Minister of Commerce, said that after consultation with the Electricity Board for Northern Ireland his Ministry had agreed to offer no objections to residents in border areas taking supplies from the Eire Electricity Supply Board where the Northern Ireland Board was unlikely to provide supplies in the near future.

* * *

Writing to *The Times*, Dr. H. Motz, of the Engineering Laboratory, Oxford, tells the story of a young local cuckoo which (a reversal of the usual practice) was apparently expelled from the blackbird's nest in which it was hatched. Dr. Motz says:—

> "It fell into a basement in front of our high energy accelerator, out in the open, where we usually direct the X-ray beam. We dare not run the machine for fear of hurting the bird. Latinists or not, we are not inhuman, we scientists. But, who knows, maybe the X-rays would induce mutations which might make the wretched bird build its own nest in future?"

* * *

In Ulster electric fish-stunning equipment is being employed by fishery authorities to sort out such "undesirable" fish as roach from the more valuable salmon and trout. *Ulster Commentary*, published by the Northern Ireland Government, says that when the fish have been stunned they are netted; the "undesirables" are destroyed and the other fish restored to the water. It has been proved that within a minute of being restored to their natural surroundings they are fully recovered and suffer no ill-effects from the "electrification."

* * *

Somewhat limited approval was given to Marconi's wireless telegraphy system in the *Electrical Review* of 2nd June, 1899. In view of later developments the caution displayed in the paragraphs quoted below is rather amusing:—

> "Recent experiments have fairly well demonstrated that Marconi's system of telegraphy is quite reliable for moderate distances under all conditions of weather experienced in England, and there can now scarcely be any doubt that it will be equally successful in other parts of the world. It will be very useful as an adjunct to the ordinary lines in cases of accidental breaks where there are serious obstacles to restoration and, we should say, almost necessary in modern warfare, at times when visual signalling cannot be carried on either by stress of weather or owing to the configuration of the country. . . . Reviewing all the circumstances which have been made public, there is thus every reason to believe that electrostatic telegraphy, if it is able to surmount climatic difficulties, can be easily installed and can be operated by the average signaller, will have a large sphere of usefulness."

NEW ELECTRICAL EQUIPMENT

Fast Boiling Electric Kettle

The new Hotpoint "Hi-Speed" 3-pint electric kettle recently introduced by A.E.I.-HOTPOINT, LTD., 33, Grosvenor Place, London, S.W.1, has a loading of 2·3 kW and, it is claimed, can boil a pint of water from cold (62 deg F) in less than two minutes. Fast expansion and contraction on heating and cooling reduces formation of scale in hard water districts and allows the element to be set low in the kettle so that only 0·9 pint of water will cover it.

This extra-fast rate of boiling is perfectly safe because an automatic self-resetting cut-out device operates if the kettle is switched on when empty or allowed to boil dry. The cut-out will remain in the off position until the kettle is refilled or the supply is switched off and is automatically re-set as the kettle cools.

Other features of the kettle are the attractive shape of its copper body, nickel plated internally and chromium plated on nickel externally; a moulded easy-grip handle, in red or black; a large lid for easy filling; and a short, easy-pouring spout. The non-scratch insulated feet enable the kettle to be placed on the tea-table.

A.E.I.-Hotpoint 3-pint "Hi-Speed" electric kettle

It is available in 200/220, 220/230 and 230/250 voltage ranges and alternative loadings of 1·5 and 1 kW can also be supplied. The 1 kW model is also available in a 110/120 V range which, with the 220/230 V range, is primarily for export by A.E.I.-Gala, Ltd.

The prices, including purchase tax in the United Kingdom, are £4 18s 6d (2·3 kW) and £4 16s 6d (1½ and 1 kW).

Plug-in Limit Switch

The plug-in precision limit switch, type AW-36, introduced by SQUARE D, LTD., Cheney Manor, Swindon, Wilts., has roller plunger actuation with a fine adjustment of the roller initial position over a full ⅛in range. The roller can be located in its proper relation to the cam track after the switch has been mounted and wired.

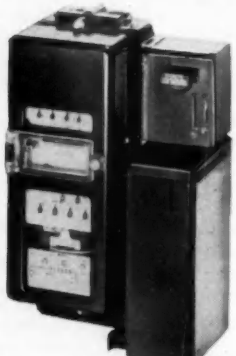
Square D limit switch

The normal roller operating direction is parallel to the bottom of the box, but the roller plunger can be rotated through 90 deg if required.

The snap action switch contacts are single pole, double throw, with isolated normally open and normally closed circuits. The diecast box enclosure has a conduit entrance at one end, and the switch, roller plunger and overtravel mechanism are attached to the cover. Of oiltight construction, the switches are suitable for mounting on machine tools in the presence of cutting oils. A similar switch, but without the plug-in feature, designated type AW-32, is also available.

Florin Prepayment Meter

The type FMmP prepayment meter manufactured by FERRANTI, LTD., Hollinwood, Lancashire, can now be supplied for operation by two-shilling pieces in addition to the more usual shilling, benefiting both the supply authority and the consumer. The price per kWh is variable between ¾d and 8d and the door giving access to the price change mechanism is sealed separately. A large coin box is provided and the coin mechanism is readily detachable should it become jammed through the use of faulty or damaged coins. A return chute is added to the dual coin meter so that if a shilling is inadvertently inserted in the two-shilling slot it is returned to the consumer. Single-coin meters for either a shilling or a florin are also available.



Ferranti prepayment meter

Exterior Lighting Fittings

The introduction of a series of exterior area lighting fittings is announced by PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, for use with their 80/125/250 W, MBF/U mercury fluorescent lamps. Designed primarily for lighting such outdoor areas as service stations and factory yards, etc., these cut-off type fittings comprise a hot galvanised sheet steel stove enamelled spinning, with a grey exterior and white interior finish. Heavy gauge steel canopies tapped ¾in B.S.P. with a set screw for locking are provided, and two adjustable and removable anodised aluminium reflectors are fitted to throw narrow controlled glare-free beams of light on either side of the fitting. The type R.8200 fitting, for 80/125 W lamps, has a list price of £9 7s 9d and the corresponding price for the type R.8210 fitting for 250 W lamps is £14.

Philips lighting fitting

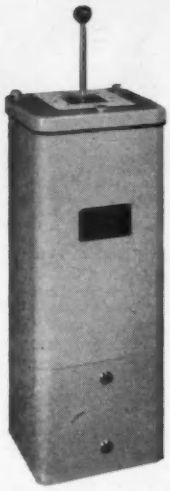
Cam-Operated Master Controllers

The master controllers developed by ALLEN WEST & CO., LTD., Brighton, 7, for a.c. or d.c. control circuits up to 650 V for rolling mills, chargers, heavy service cranes, and other applications demanding frequent operation with limited time available for routine maintenance, incorporate a plug-in control unit which may be withdrawn without breaking any interconnections.

Three types are available: the type "PMC" is a conventional single unit with twin contact bars; the type "PUMC" is similar, but arranged to control two motions by a single universal operating lever; and the type "PNMC" is a single unit with single contact bar to give reduced overall width. The main operating shaft carries machine cut moulded cams which actuate the various contact units. A maximum of seven

notches can be supplied, the notching positions being accurately registered by a pawl mechanism, and up to 24 contacts are provided.

The plug-in air break contact system forms a single integral unit independent of the main camshaft and



Allen West master controller

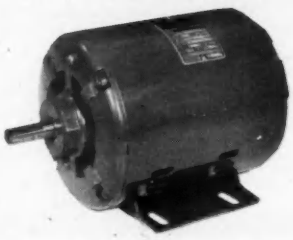
terminal bar. Each moving contact lever is operated by the action of a cam against the lever roller. The contacts are double-break pattern, silver faced to minimise contact resistance, and close under heavy spring pressure. Each contact unit is connected with its associated main terminal by a silver-tipped spring-loaded contact. Adjacent units are separated by insulating barriers. Any standard form of cable fitting can be provided at the back, bottom or side of the sheet steel case, but side entry is limited to one gland only.

F.h.p. Motors

A range of fractional horsepower motors, complying with B.S. 170 and having the mounting dimensions of American Standard N.E.M.A. 48, is announced by CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2. The series, designated T.45, provides for seven mounting methods, including solid-foot, resilient, end-face, and oil burner flange. A large terminal box is incorporated in the endshield, a conduit entry hole is provided in the stator frame, and slots provide an alternative entry for t.r.s. cables. Four tapped projections on the driving endshield can be machined to provide a spigot for mounting driven equipment on the motor.

To comply with N.E.M.A. Standards, the motors have a $\frac{1}{4}$in diameter shaft extension. Bearings are of $\frac{3}{8}$in diameter, allowing $\frac{3}{8}$in diameter shafts to be provided at either end of the machine for a small extra cost. The rotors have pressure die-cast windings and polyvinyl acetyl resin is used to insulate the stator windings. The "T.45" range is available for three-phase working at ratings from $\frac{1}{20}$ h.p. at 960 r.p.m. to $\frac{1}{2}$ h.p. at 1,425 r.p.m. For single-phase working, the range extends from $\frac{1}{30}$ h.p. at 960 r.p.m. to $\frac{1}{3}$ h.p. at 1,425 r.p.m.

Crompton Parkinson f.h.p. motor



Automatic Telephone

The "Aristocrat FL.50" automatic telephone manufactured by AUTOPHONE, LTD., 73, Great Peter Street, London, S.W.1, is housed in a moulded case of shock resisting plastic material available in a range of five colours. The outer dial ring assists dialling as the figures are visible from a wide angle, and the ring is moulded from a scratch resisting material with the numbers on the underside of the moulding to prevent marking or obliterating the figures.

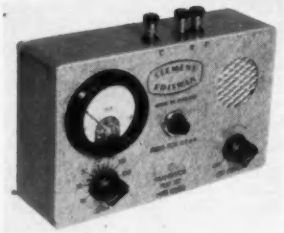
All components are mounted directly on the baseplate and access is easily obtained for maintenance by undoing three screws and removing the cover. A cradle lock is provided to disengage the instrument from the switchboard during servicing and is automatically re-set when the cover is replaced. The volume and tone of the bell can be adjusted to give a ringing or buzzing indication.

Transistor Tester

A transistor beta tester introduced by SIEMENS EDISON SWAN, LTD., 155, Charing Cross Road, London, W.C.2, provides quick, accurate, routine tests on all p-n-p transistors, current gain and collector leakage being measured under common emitter conditions. Current gain 10 to 150 is read directly off a calibrated dial in conjunction with an audible signal at a collector current of 0·5 to 4 mA, and the leakage current is measured on a meter at a fixed collector voltage of 9 V. The accuracy is 5 per cent.

The new tester is a battery operated transistorised unit in a die-cast alloy case, and the terminals are of the quick release type. Full operating instructions are printed on the back cover of the tester, which has a list price of £11.

Siemens Edison Swan transistor tester



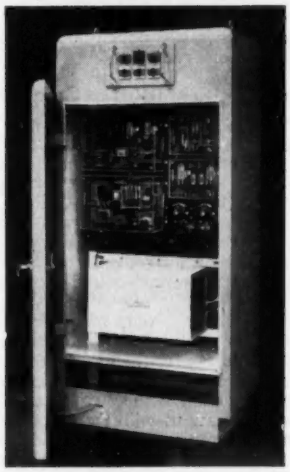
Automatic Precipitator Voltage Control

The type MR electrostatic precipitator automatic voltage control cubicle was developed by the STURTEVANT ENGINEERING CO., LTD., Southern House, Cannon Street, London, E.C.4, for use with precipitator high-tension equipment of the mechanical rectifier type. Signals received from the precipitator, indicating the necessity for adjustment of the h.t. supply, are transformed into suitable remedial measures to adjust the level of the power input, so that at all times the precipitator will operate at its highest efficiency. Severe instability will break the high-tension supply, with automatic reinstatement after a short interval, and prolonged instability will initiate an alarm.

The design is based on the steep rise in current following a breakdown of the inter-electrode gap within the precipitator. A system of relays and time switches is employed in conjunction with a motor driven voltage regulator. The signal voltage for the relays is derived from a current transformer connected in series with the primary of the main high voltage transformer. A transient primary current increase will induce a corresponding increase of the c.t. secondary voltage to which the appropriate relay will respond. The supply voltage will then be reduced to a value depending upon the duration of the signal. After a pre-set interval the voltage is restored to its original optimum value.

Adjustment is provided to govern the sensitivity of the control relays by variable resistors and a c.t. tap changing switch affording fine and coarse control respectively. Automatic reclosing is also provided, limited to three attempts in the event of severe and prolonged disturbance.

Sturtevant voltage control unit



INDUSTRIAL NEWS

Dollar Imports Freed from Control

Domestic electrical appliances, radio, television and sound reproducing apparatus are among the many consumer goods from the Dollar Area which will be freed from import control from next Monday, 8th June. Control is also removed from certain electrical and scientific instruments, calculating machines, computers, radio communication and navigation aids and telegraph and telephone apparatus.

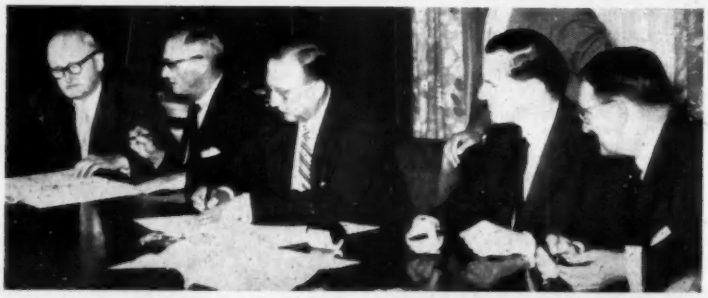
The new measures are in accordance with the undertaking given by the President of the Board of Trade at the Commonwealth Economic Conference in Montreal last September. Though it is impossible to estimate precisely the effects of the new measures on the balance of payments, no significant addition to the total import bill is expected. All the goods to be liberalised may already be imported without restriction from Europe, and United States and Canadian exporters are now being given the opportunity to compete with existing overseas suppliers. Changes in the pattern of U.K. imports, rather than a gross increase are, therefore, thought officially to be the most likely results.

The Board of Trade has made a new Open General Licence (H.M. Stationery Office, price 1s 6d), under which all goods from the Dollar Area, except those listed in the schedules, may be imported without an individual licence. Electrical goods for which individual licences will still be required include switchgear and switches incorporating timing devices, electromedical apparatus and parts, non-domestic refrigerators and refrigerating machinery, welding machines, valves and tubes including crystal valves but excluding cathode ray tubes, and X-ray apparatus, tubes and parts. A Notice to Importers, No. 910, which sets out the revised licensing arrangements, was issued last week by the Board of Trade.

Opportunities in the Commonwealth

A plea for British business men to visit countries such as South Africa and Australia was made by Mr. John Oldham, O.B.E., chairman, Oldham & Son, Ltd., last week. He was giving "the impressions of an ordinary business man" on his return from a three and a half months' round-the-world tour.

He said that if only more heads of businesses would follow his example and go and see for themselves the rich possibilities that existed in the Commonwealth, the trading and personal relations with these countries would be transformed. It could not be done by reading books or reports.



Signing the agreement between the G.E.C. and M.A.N. at Nürnberg. Left to right: Professor Sörensen (M.A.N.), Mr. Arnold Lindley (assistant managing director, G.E.C.), Herr Ulrich Neumann (director general, M.A.N.), Mr. R. N. Millar (G.E.C.) and Herr Hans-Fischer (M.A.N.)

British industry must get into the habit of going and meeting its opposite numbers in those countries and getting the atmosphere as well as the background. If Britain did not meet the challenge offered by the opportunities for investment there were plenty of other countries which would. Though the number of British companies opening up in South Africa and Australia was increasing Mr. Oldham considered it was still not nearly enough.

World Rubber Supply

The Management Committee of the International Rubber Study Group examined the statistical position of rubber, and made estimates for requirements and supply of rubber as a whole (natural and synthetic together) during 1959. It was estimated that the world might consume, i.e. turn into manufactured goods, some 3,520,000 long tons of natural and synthetic rubber, apart from synthetic rubber produced in non-member countries; this estimate is on the assumption that non-member countries, notably the U.S.S.R., will continue to purchase natural rubber at the relatively very high rate at which they have bought in recent months. It was estimated that the world supply of natural rubber would be at least 1,970,000 tons, and possibly materially higher, while the annual production capacity of synthetic rubber in member countries is of the order of 2,040,000 tons. In view of uncertainties, notably as to the requirements of non-member countries and of the effect of recent price movements, it was not considered possible to forecast at this stage the relative shares of total consumption which will be met by natural rubber and by synthetic rubber.

G.E.C.-M.A.N. Nuclear Ageerment

As we reported in our last issue, the General Electric Co., Ltd., and Maschinenfabrik Augsburg-Nürnberg A.G. (M.A.N.) have concluded a ten-year agreement on the development of nuclear power. The accompanying picture shows the agreement being signed at Nürnberg.

Dryers for Italian Nuclear Power Station

An order has recently been placed with the Dryer and Gas Plant Division of Birlec, Ltd., for two dryers to be supplied to the Italian nuclear power station under erection at Latina. They will be installed in the main reactor cooling circuits and will remove water vapour from the carbon dioxide gas used in the heat transfer system.

New Henley Company

An agreement has been reached between W. T. Henley's Telegraph Works Co., Ltd., and the Investment Corporation of India (Tata) for the manufacture of certain types of cable in India, and a company will shortly be formed by them in which Henley's will have a 60 per cent interest and Tata 40 per cent. The necessary industrial licence has already been granted by the Government of India for this project.

Wire Manufacturers' Centenary

Frederick Smith & Co. Wire Manufacturers, Ltd., Halifax, are celebrating their centenary in October next. Mr. Frederick Smith founded the company in 1859, originally for the purpose of manufacturing wire for the textile industry, which used it as a medium for wool carding (his father, Thomas Smith, was a card maker in Halifax, supplying the needs of the textile industry), and although the company now manufactures wires for many other purposes, card wire is still one of its specialised products. In 1864 Mr. Frederick Smith was joined in partnership by his brother, Matthew, and it became a limited company with its present title in 1897. After the death of Mr. Matthew Smith in 1880, the business was continued by his sons, Frederic and George.

The production of copper wire was

moved from Halifax to Salford in 1898, and the Salford factory was amalgamated in 1909 with the London Electric Wire Co., of Leyton, and constituted a part of the company known today as the London Electric Wire Co. & Smiths, Ltd. The ferrous side of the business continued as a separate entity at Halifax under the direction of Mr. George Smith and his sons Percival and Clifford, Frederic Smith having moved to Salford to conduct the copper wire side of the concern.

The Smith family remains actively engaged in the affairs of the company, the managing director being Mr. Clifford Smith, a great nephew of the founder. Mr. George Smith, son of Mr. Percival Smith, Mr. Peter Smith (deputy managing director) and Mr. Anthony Smith, both sons of Mr. Clifford Smith, represent the fourth generation within the company, and the fifth engaged in the use or manufacture of wire.

F.h.p. Motor Manufacturers Extend

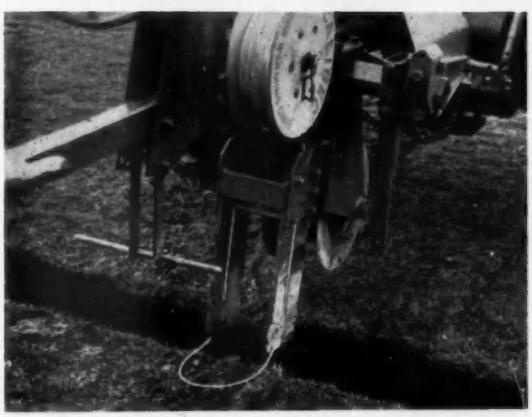
New and larger premises have been taken over by the Acadex Engineering Co., Ltd., at Honeywood Road, Basildon, Essex (telephone: Basildon 20261). The company makes transformers and produces motors for sewing machines, fan heaters, small ciné projectors, control gear, record players and juke boxes. It was formed four years ago and has moved twice to larger premises. The new factory has a covered area of 20,000 sq ft with room for expansion to 36,000 sq ft. Under-floor heating is installed in the offices and factory.

Installation of Heating Cable

A machine to lay underground electric heating cables for frost protection in sports grounds has been developed by Harrison, McGregor & Guest, Ltd., a subsidiary of the David Brown Tractor Division, in collaboration with the St. Ives Turf Research Station at Bingley and the Yorkshire Electricity Board. To ensure even heating of the turf and to prevent the cables from being damaged through turf spiking and other renovating operations, the cables, some $\frac{3}{16}$in in diameter, must be laid in lines 6$\frac{1}{2}$in apart and 6in below ground level with a maximum permitted misalignment of $\frac{1}{4}$in, while there must be minimum disturbance of the turf.

The machine, which has been designed for fitting to a standard David Brown 950 tractor, lays two cable runs simultaneously, looped at one side or end of the field. Two vertical blades cut narrow slits into the turf and the plastic covered cable is fed into position through these slits, the surface cuts being removed by a roller after laying has been completed. Pointers on the tractor enable the driver and operator to follow a straight course. The David Brown Co. plans to undertake cable laying on a contract basis. It is estimated that the cost of carrying out this work on a full-sized football pitch would be approximately £400, and this covers the laying of 30 to 35 miles of cable.

Cable laying attachment



Carron Bi-Centenary

This year marks the 200th anniversary of the Carron Company, Ltd., and it has issued a well-produced and illustrated booklet in which it outlines the history of the company. The booklet is interestingly written and contains a good deal of historical interest.

Meat Meals Demonstration

Meat every day cooked by electricity was the theme of a meat meals demonstration organised by the Fatstock Marketing Corporation, Ltd. (F.M.C.), at Swindon recently in collaboration with the Electrical Association for Women. A packed audience of housewives saw F.M.C.'s kitchen demonstration unit flanked by a No. 1 Tricity "Marquis" cooker, a Belling "47 Plus" and a Frigidaire "M.Z. 452," which were operated by Mrs. Parsons, cookery demonstrator for the South Eastern Electricity Board. A talk was given by Mr. E. St.J. Height, public relations officer for the F.M.C. The Fatstock Marketing Corporation offered prizes of electrical equipment to the value of £20 for the best menu for four people and costing no more than ten shillings.

Mrs. Parsons giving a cookery demonstration at Swindon

Increased Competition Forecast

Increased competition among manufacturers was forecast by Mr. Nicholas A. H. Stacey, head of the G.E.C. Economic and Marketing Research Unit, in an address at Harrogate last Tuesday at the Diamond Jubilee Conference of the National Federation of Ironmongers. Mr. Stacey was speaking on "The Distributive Thaw" and his theme was that mass production called for mass distribution. The channels through which goods travelled from the manufacturer to the consumer were, he emphasised, already undergoing radical changes. On the one hand there was the manufacturer's desire to get as close to the final customer as possible; on the other there was the evolution of retailers' co-operatives and voluntary purchasing groups. In these circumstances the number of large accounts was inevitably tending to grow, while the total number of accounts was tending to diminish. Consequently competition among manufacturers would increase and the manufacturer's sales approach would have to change.

Level Control Equipment Agreement

Fielden Electronics, Ltd., and Lancashire Dynamo Electronic Products, Ltd., announce the conclusion of an agreement that no level control equipment manufactured or produced by Lancashire Dynamo Electronic Products of a type now or previously

manufactured or produced by them or the use of the equipment for level detection or control shall be regarded as infringing or having infringed any of the patents or patent applications of Fielden Electronics. Similarly, no level control equipment manufactured or produced by Fielden Electronics of a type now or previously manufactured or produced by them or its use for level detection or control shall be regarded as infringing patents or patent applications of Lancashire Dynamo Electronic Products. The agreement is strictly confined to the products of these two companies.

Substation Equipment Order

An order valued at approximately £400,000 has been placed with the General Electric Co., Ltd., by the Central Electricity Generating Board for the whole of the equipment for a 9-bay extension to the 132 kV substation at Willenhall. Also included are the replacement of seven existing circuit-breakers by new circuit-breakers of higher rupturing capacity, and provision for the future addition of seven further bays. The sixteen circuit-breakers will be of the bulk-oil type, pneumatically operated and rated at 3,500 MVA. Although standby local control panels are being installed, Willenhall will normally operate as an unattended station remotely controlled from Walsall.

George Montefiore Prize

The Association des Ingénieurs Electriciens and l'Institut Electrotechnique Montefiore (A.I.M.), Rue Saint-Gilles, 31, Liège, Belgium, announce that the Fondation George Montefiore quinquennial competition will be held next year. A prize of 100,000 Belgian francs will be awarded for the best original work submitted on scientific advance and progress in the technical applications of electricity in all spheres. The closing date for the receipt of works is 1st July, 1960.

Equipment for Berkeley Power Station

Several boiler gas circulator panels to be installed in the Berkeley nuclear power station are now being completed in the Harlow factory of Sunvic Controls, Ltd. Each panel will be used for the measurement and control of a gas circulator and the associated heat exchanger, and will be brought into service on the plant during starting, maintenance and for major plant changes.

"Outer Seven" Trade Talks

A third series of talks at expert level have been taking place in Stockholm this week between representatives of the so-called "outer-seven" countries of Europe—Britain, Switzerland, Austria, Portugal, Denmark, Norway and Sweden. The discussions have been concerned with proposals for the removal of barriers to trade between these countries in a manner consistent with the development of world-wide multi-lateral trade and the provisions of the G.A.T.T. In agreeing to take part the British Government have been moved by the belief that if such an association could be created, it would not only be valuable in itself but would also make possible a new approach to European economic co-operation.

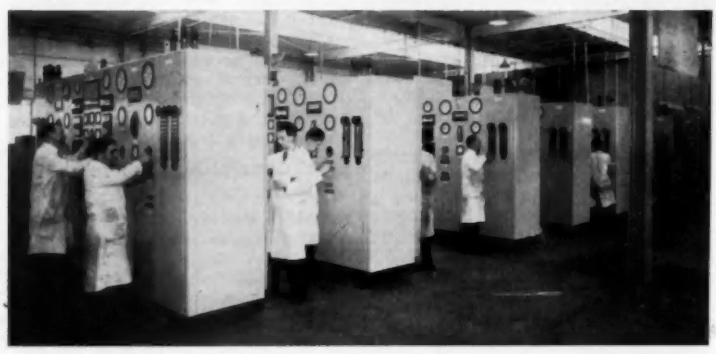
Though it is too early to say what increase in trade might result, the scheme is thought to make good economic sense. At present the other members of the "outer seven" import considerably more from the Common Market countries than from Britain, but the Government hope that if a free market is established the gap would be reduced in favour of Britain. The different size of the two groups should, however, be borne in mind. The combined population of the seven is 88 million, including 51 million in Britain. The Common Market countries have a population of more than 160 million.

Batti-Wallahs' Society

The guest speaker at last week's luncheon of the Batti-Wallahs' Society was Mr. W. G. Thorpe, line traffic manager of the Great Eastern Section of the Eastern Region of the British Railways, who spoke on the modernisation of the Great Eastern Section. He said that the area covered was at one time predominantly agricultural, but with industry spreading into the eastern counties, the pattern of traffic was changing rapidly. He referred to the strain upon the railways during the war years and the need for rehabilitation in the immediate post-war years. The modernisation had been delayed by shortages of money and of materials, particularly of steel, but when these became more freely available, the work of rehabilitation began. Electrification and "dieselisation" went hand in hand; diesel traction would pave the way to electrification. He said that the modernisation would not only save money, but would increase passenger traffic as the public would be attracted by the modernised equipment. He referred to the opening last month of the Colchester-Clacton electrification, which was the first commercial service under the modernisation scheme of the British Railways to operate at 25 kV 50 c/s.

Mr. J. Temple Hazell (president) was in the chair and a vote of thanks to Mr. Thorpe was proposed by Mr. J. W. Perkins. Mr. T. C. F. Bigland (the "Mate") announced that the speaker at the next luncheon (Wednesday, 24th June) would be Sir Christopher Hinton.

Control panels for Berkeley nuclear power station in the Sunvic works



Thermoelectric Generator

According to a report in *The Times*, a contract to design, construct, test and furnish a 5 kW thermoelectric generator in the hope that it will lead to the development of a system for use in ships has been placed by the Bureau of Ships, United States Navy, with the Westinghouse Electric Corporation. Basically the thermoelectric generator converts the heat of a burning fuel directly into electricity, omitting the steam cycle, and it is claimed that the contract calls for a larger power output than that of any generator of similar type known to have been constructed.

"Big Ben" Becomes a Centenarian

To mark the 100th birthday of "Big Ben," the Westminster clock, an exhibition opened on Wednesday last in the Jewel Tower, Abingdon Street, S.W.1, which portrays in sight and sound many events on which "Big Ben" has looked down during its first hundred years. The exhibition will remain open to the public for the rest of the summer. In addition to the seasonal floodlighting of "Big Ben," the orb and cross on top of the clock tower are picked out by special lighting, and there is a band of lighting round the balcony at belfry level.

Dexion Exhibition

During the past few days a display of building products has been staged by Dexion, Ltd., manufacturers of slotted angle, at their Overseas Division premises at Stonebridge Park, Wembley, Middlesex. The exhibition, which had been organised to show under one roof the wide range of

Dexion products and accessories now available, was officially opened on 26th May by Mr. John Rodgers, Parliamentary Secretary to the Board of Trade.

Several new products were shown for the first time, including galvanised Dexion, multi-purpose grid, and "Tecon" timber products. Other products on view included the company's recently introduced "Viadex" cable trays and cable fixing system. In an open-air section of the exhibition several structures demonstrated the versatility of Dexion, among which was a 50ft tower suitable for use as a radio, TV or radar tower. A number of films were shown during the course of the exhibition.

Anglo-U.S. Nuclear Equipment Company

The setting up of an Anglo-American company to specialise in the design, manufacture and marketing of remote-controlled handling apparatus was announced on Monday last by Savage & Parsons, Ltd., Watford, and General Mills, Inc., Minneapolis, Minnesota, U.S.A. The new company, Nuclear Equipment, Ltd., will have its head office at Otterspool Way, Watford.

The new organisation will maintain close contact with nuclear establishments throughout the world, with the exception of the United States, although its principal markets will be in the British Commonwealth and Western Europe. The company will be concerned with both mechanical and power manipulators, reactor fuel loading and unloading systems, reactor maintenance systems, and other types of handling apparatus and ancillary protective equipment.

The board of Nuclear Equipment, Ltd., will be Messrs. J. B. Savage and G. A. Lingham, directors of Savage & Parsons, Ltd.; and W. A. Stephens, assistant general manager, Mechanical Division, General Mills, Inc., and G. O. Haglund, director of that Division's Nuclear Equipment Department. Mr. J. B. Savage will be managing director of the new company. The controlling interest is held by the British partner, which has been concerned with the design and manufacture of this type of equipment since 1954.

English Electric-North American Aviation Agreement

An agreement has been signed between North American Aviation, Inc., acting through its Atomics International Division, of Canoga Park, California, and the English Electric Co., Ltd., providing for collaboration between the two companies in the field of organic liquid cooled reactor systems. Atomics International has carried out extensive research and development, much of it in association with the United States Atomic Energy Commission, on this reactor, which shows considerable promise as a potential low-cost system particularly applicable to smaller nuclear power stations and also to nuclear marine propulsion.

The English Electric Co. has so far devoted almost the entire resources of its Atomic Power Division to the gas-cooled graphite-moderated reactor system for large power stations. The decision by the company to pay attention to a totally different reactor system applicable to very much smaller installations is expected to place the company in a position to deal with a wider range of nuclear power inquiries.

Volume of Exports

In the first quarter of 1959 the Board of Trade volume index of United Kingdom exports of electrical machinery, apparatus and appliances was 121 (1954=100), 5 per cent below the index for the previous quarter and 8 per cent below the first quarter of 1958. The corresponding index for electrical imports at 185 was one point lower than the fourth quarter figure but 20 per cent greater than for the first quarter of last year.

Midland Silicones Sales Conference

More than twenty-five agents representing Midland Silicones, Ltd., in twenty European countries met in London last week when the company held its 1959 European sales conference. Mr. C. Caldwell, export sales manager, reviewed the European export organisation and then overseas agents and sales managers delivered a series of papers.

Kenwood in Australia and New Zealand

The Kenwood Manufacturing Co., Ltd., is to begin manufacture of its products in Australia and New Zealand. This was announced on 24th May by Mr. K. Wood (managing director) on the eve of his departure for the United States and Canada where he is meeting North American distributors of both the Kenwood and Peerless & Ericsson companies. Mr. Wood is vice-chairman of Peerless & Ericsson, the control of which was recently purchased by the Kenwood Co. Mr. A. Brooking (financial director) and Mr. F. Simpson also left by air for North America, and after meetings in New York, Chicago and Toronto they expected to arrive in Sydney, Australia, today (Friday). Mr. Wood was returning direct to England. Mr. Simpson, who has been with the Kenwood organisation almost since its inception, will remain in Australia as works manager of the Australian company. All manufacturing arrangements there will be dealt with on the spot. Kenwood already have a sales organisation in Australia operating through their subsidiary, Kenwood Manufacturing (Australia) Pty., Ltd. After visiting Australia, Mr. Brooking will go on to New Zealand where another subsidiary, Kenwood Manufacturing (New Zealand), Ltd., has already been formed. This company will also soon begin to manufacture. Mr. Brooking, during his tour of Australia and New Zealand, will also visit Peerless & Ericsson distributors. He will return to England via the Middle East, visiting distributors of both companies en route.

Trade Announcements

Blackstone & Co., Ltd., announce that all trade inquiries in Scotland for sales, service or spares should now be addressed directly to them at Baltic Chambers, Wellington Street, Glasgow, C.1 (telephone: Central 7604). By operating from the Glasgow office of the R. A. Lister group of companies, this new arrangement will concentrate sales, spares and service at the one address. By arrangement with Smail, Sons & Co., Ltd., Mr. G. A. J. Gillson has transferred to Blackstone & Co. and is now operating from the above address.

Owing to the decreasing demand for the company's products at economic prices, the management of **Weir Foundries, Ltd.**, has announced their decision to complete the closure of the foundries at Thornliebank in June. Efforts are being made to interest other industries in the use of the factory buildings.

The **Amar Tool & Gauge Co., Ltd.**, has appointed Mr. T. Kershaw as its representative for Yorkshire, Lancashire and Cheshire.

The showrooms and offices of **Farmer, Stedall & Co.'s** wholesale electrical department have moved to 192-208, Pentonville Road, London, N.1 (telephone: Terminus 3699).

The Belfast area office of the **A.E.I. Lamp & Lighting Co., Ltd.**, is now at 18, Adelaide Street, Belfast (telephone: Belfast 29368/9).

The telephone number of the Leeds branch of the **Metallic Seamless Tube Co., Ltd.**, has been changed to Leeds 35071/2.

Mr. N. M. Cockaday has joined the Ferguson Division of **Thorn Electrical Industries, Ltd.**, as sales representative for the North and East London and South East Essex area. He was previously a sales representative with Pye, Ltd.

Works Visit

A delegation from the National Defence College of Canada, led by Air Commodore G. B. Miliward, D.F.C., C.D., recently visited the Blackwood factory of South Wales Switchgear, Ltd., and after a tour of the works were entertained to lunch by Mr. A. J. Nicholas, managing director, and senior executives of the company.

Price Reductions

Aidas Electric, Ltd., has announced reductions in the prices of its "Dumpy," "Spirod" and U-Type immersion heaters.

GENERATION and DEVELOPMENT

Mr. H. J. Bennett (left) and Mr. A. R. Cooper (centre) talking to Lieut.-Comdr. Spreadbury, their pilot

Analysis of Boards' Sales

The Ministry of Power's April return of electricity generated and sent out for public supply was published in last week's issue and in the accompanying table details are given of the Area requirements of the individual Boards. The Electricity Council, in referring to the figures for England and Wales, says that the percentage increase in output during April, when corrected for weather and working days, would be 7·2.

The largest increases in April were those of the North Eastern and Midlands Boards (10·9 and 10·8 per cent, respectively) but over the twelve months ended 30th April the Southern Board made the most progress (10·5 per cent increase, compared with the 5·1 per cent average for all Area Boards), followed by the South Eastern and South Western Boards, both with 8 per cent.

At the power stations of the South of Scotland Electricity Board, 509·3 million kWh was generated and 480 million kWh sent out in April. In addition, 43·3 million kWh (against 62·4 million in April, 1958) was imported from the Central Electricity Generating Board, 24·1 million kWh (3·4 million) from the North of Scotland Hydro-Electric Board, and 19·1 million kWh (nil) from the United Kingdom Atomic Energy Authority's Chapelcross station. Total supplies to the North of Scotland Board's own Area were slightly lower than a year ago but 14·4 per cent more electricity was generated, the surplus being exported to the South of Scotland.

Floor Warming Assists Concrete Block Production

An installation of electric floor warming in two large buildings in a sand pit at Braintree has made possible the production of precast concrete building bricks and blocks during the whole of the year, the predetermined temperature of 50 deg F being sufficient to prevent any damage by frost. The system has been installed by the Eastern Electricity Board for F. A. Hunnable & Son, Ltd., Braintree, who produce precast concrete bricks and blocks in quantities ranging from 2,500 to 11,500 a day.

Upon the original floor of the buildings, believed to be about 8in thick, has been superimposed a 5in monolithic block of concrete in which the plastic insulated heating cables are laid. One building is divided into twelve bays and the other into nine and the warming cables are laid in the form of a grid lengthwise in twelve sections, each covering a surface of 50ft by 6ft. There is a 4½in gap between each wire and the loading on each bay is 2·9 kW. The floor temperature will be about 60 deg F with an air temperature of about 50 deg F.

Inspection by Helicopter

Helicopters are being increasingly used for business purposes. They enable much time to be saved where widespread establishments have to be visited, particularly in these days of congested roads. The Central Electricity Generating Board, whose power stations are dotted all over the country, has begun to use helicopters. Last week Mr. A. R. Cooper, a full-time member of the Board, and Mr. H. J. Bennett, director of the London, South East and East Region, managed to inspect three stations in one day. Starting from the new Battersea "heliport" they first went to the new Northfleet (Kent) station. From there they flew to the Bradwell (Essex) nuclear station and then went on to Little Barford (Hunts). This is not only a quick way of inspecting such undertakings; it also gives a better all-in picture of progress.

Irish Supply Board's Plans

The Electricity Supply Board of Ireland is drawing up plans for four new generating stations using milled peat as fuel. The plans are based on an estimated 7 per cent annual increase in consumption until 1964. Three of the new stations will be at Rhode, County Offaly, and the fourth will be at Bellacorick, County Mayo. Two of the stations at Rhode will have a capacity of 20 MW and will be commissioned in June, 1960, and August, 1961, respectively. The third, with a capacity of 40 MW, will be ready in 1962. The Co. Mayo station will be completed in 1962.

Although the Electricity Supply Board now emphasises that as much power as possible should be generated from Irish peat produced by Bord na Mona (the State Peat Development Board) it is recognised that supplies

ELECTRICITY SENT OUT BY BOARDS FOR THEIR CONSUMERS

Area Board	Totals for April (million kWh)			Twelve Months Totals Ended 30th April (million kWh)		
	1958	1959	Inc. or Dec. %	1958	1959	Inc. or Dec. %
London	639·2	651·3	+ 1·9	7,522·5	7,824·7	+ 4·0
South Eastern	433·9	440·6	+ 1·5	4,936·9	5,329·8	+ 8·0
Southern	533·2	579·8	+ 8·7	6,211·3	6,860·6	+10·5
South Western	263·4	279·7	+ 6·2	3,023·6	3,266·6	+ 1·0
Eastern	669·5	698·8	+ 4·4	7,929·3	8,413·9	+ 6·1
East Midlands*	543·0	588·3	+ 8·3	6,622·4	7,005·1	+ 5·8
Midlands*	711·3	787·8	+10·8	8,578·7	9,118·0	+ 6·3
South Wales*	415·4	445·5	+ 7·2	4,938·6	5,142·2	+ 4·1
Merseyside and N. Wales*	429·6	461·7	+ 7·5	5,194·8	5,449·2	+ 4·9
Yorkshire*	698·9	742·9	+ 6·3	8,601·4	8,710·6	+ 1·3
North Eastern*	411·5	456·3	+10·9	5,004·3	5,152·1	+ 3·0
North Western*	716·1	766·1	+ 7·0	8,845·4	9,076·2	+ 2·6
Total all Area Boards	6,465·0	6,898·8	+ 6·7	77,409·2	81,349·0	+ 5·1
Direct Supplies by C.E.G.B.	235·1	263·9	+12·3	2,630·0	3,082·6	+17·2
Grand Total	6,700·1	7,162·7	+ 6·9	80,039·2	84,431·6	+ 5·5
Mainly Industrial Areas*	3,925·8	4,248·6	+ 8·2	47,785·6	49,653·4	+ 3·9
Mainly Non-Industrial Areas	2,539·2	2,650·2	+ 4·4	29,623·6	31,695·6	+ 7·0
South of Scotland E.B.	532·5	566·5	+ 6·4	6,425·6	6 815·0	+ 6·1
North of Scotland H.E.B.	124·8	124·3	− 0·4	1,491·2	1,554·6	+ 4·3

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.

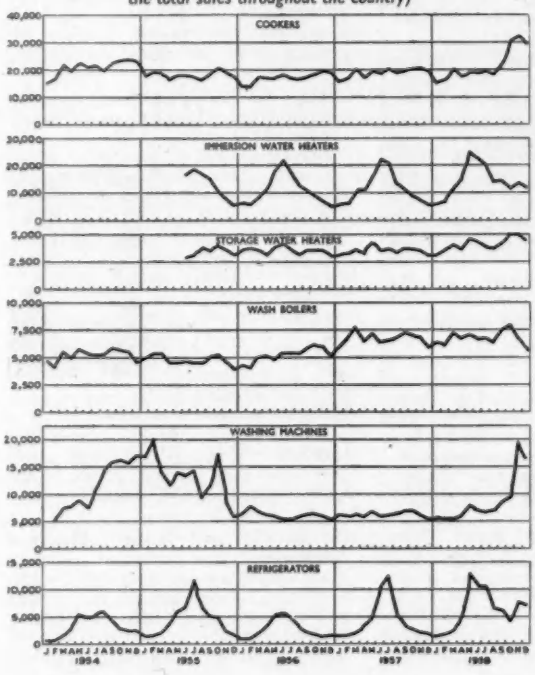
of Irish peat suitable for generation may be completely used up in ten years' time. This problem is already being studied by the Ministry of Industry and Commerce and it is believed that by the end of the next ten years plans will have to be worked out for linking up electricity supplies in the Irish Republic with Northern Ireland's system and with Great Britain and, through these two countries, with the Continent. Talks on this plan have already taken place between countries in the O.E.E.C.

Very little progress has been made towards linking the Northern Ireland system with the Irish Republic. There has, however, been some co-operation. The Electricity Supply Board's station at Cathleen's Falls on the River Erne derives its water supplies from Lough Erne in Northern Ireland. A further indication of closer co-operation was given in the Northern Ireland House of Commons recently when the Minister of Commerce said that certain towns and villages on the border would soon get electricity supplies from the E.S.B.

Domestic Appliance Sales Trends

The accompanying graphs, reproduced from a folder published by the Electricity Council (see *Electrical Review*, 29th May, page 1024), show the month-by-month sales of six of the main types of domestic electrical appliances by Area Boards in England and Wales over the years 1954-58. During that period sales were affected at various times by Government Orders in view of prevailing economic conditions. The principal measures were as follows:—*25th February, 1955.*—Hire-purchase restrictions introduced. *26th July, 1955.*—Hire-purchase restrictions increased on all appliances except cookers and wash-boilers. *31st October, 1955.*—Purchase tax increased on all appliances except cookers and wash-boilers. *18th February, 1956.*—Hire-purchase restrictions increased on all appliances. *16th April, 1958.*—Purchase tax halved on water heaters, washing machines and refrigerators. *16th September, 1958.*—Hire-purchase restrictions removed from cookers, wash-boilers and water heaters and eased on other appliances. *29th September, 1958.*—All hire-purchase restrictions removed.

Graphs showing sales of new domestic appliances by Area Electricity Boards (these, of course, represent only a part of the total sales throughout the country)


COOKERS
IMMERSION WATER HEATERS
STORAGE WATER HEATERS
WASH BOILERS
WASHING MACHINES
REFRIGERATORS
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1954
1955
1956
1957
1958

OVERSEAS

Sea-Water Power Scheme

The South Australian State Electricity Trust is considering a proposal to generate power from sea water stored in a reservoir specially built on high land near the ocean. Cost of erecting the necessary plant, etc., is estimated at £10-£12 million. Should the scheme be adopted it will be the first of its type in Australia. The quantity of water required would be about 500 million gallons an hour, and a large dam would have to be constructed close to the water source.

Canadian Nuclear Experiment

Atomic Energy of Canada, Ltd., has announced plans for the development of a more economically designed nuclear power reactor suitable for use in the remote areas of Canada, including the Arctic. Known as OCDRE (organic - cooled, deuterium - moderated reactor experiment), it will differ from the type of reactor which Canada has already developed in that it will use an organic liquid, rather than heavy water, to transfer heat from the uranium fuel to the steam generators. Heavy water will still be used as the moderator. A $600,000 contract has been awarded to the Canadian General Electric Co., Ltd., for the design, study and development of the project.

The organic liquid proposed to be used is a mixture of polyphenyls which costs only about 40 cents a lb. Because the organic liquid has a high boiling point, a low pressure system could be used. The one difficulty with organic liquids is that, when subjected to radiation, they form tars which have to be continually replaced by fresh liquids to maintain the required property of the coolant.

New South Wales Commission's Operations

The New South Wales Electricity Commission made a net profit in 1957-58 of £89,573 on income of £43 million. Sales of electricity totalled 5,806 million kWh, an increase of 12·9 per cent. The average price per kWh sold fell from 1·805d to 1·762d. A record demand of 1,410 MW was carried on the Commission's system on 25th June, 1958, which was 183 MW (15 per cent) greater than the highest demand of the previous year. The value of fixed assets increased by £22 million to £168 million, while loan liability increased by £11½ million to £148 million. Generating plant totalling nearly 139 MW was added to the system and the aggregate effective capacity of installed plant at 30th June, 1958, was just under 1,611 MW.

Work continued on the Tallawarra, Macquarie, Wallerawang and White Bay (steam), Warragamba (hydro-electric) and Broken Hill (i.c. engine) power stations and a start was made on a 30 MW steam station at Muswellbrook and a 6 MW hydro-electric station at Keepit Dam.

Two further sections totalling 128 miles of the 330 kV system (initially in service at 132 kV) which will ultimately extend from the hydro-electric power stations of the Snowy Mountains scheme in the south of the State to Armidale in the north, were completed. Construction was well advanced on two other sections (totalling 139 miles) between Yass and the Snowy Mountains Authority's Upper Tumut switching station and between the Sydney North terminal station and Lake Macquarie power station. The transmission system based on Tamworth power station was connected to the main network by the new Muswellbrook-Tamworth line.

Tasmanian Hydro-Electric Development

All Tasmania's electric power is derived from hydro-electric projects, and the State's planners aim at an ultimate generating capacity of three million h.p. So far, it is believed, only a quarter of the potential hydro-electric capacity has been harnessed. Between 1952 and 1957 consumption of electricity doubled, with major industries using about two-thirds of the output. Recently completed projects include the Wayatinah power station, while the Liapootah power station, now under construction, will have a capacity of nearly 84 MW. The largest single development being undertaken, however, is the 300 MW Great Lake scheme. The first plant is expected to be in operation by 1963.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The London Electricity Board has appointed **Mr. P. A. Lingard,** B.Com., as chief commercial officer of the Board to succeed **Mr. F. C. Fenton,** O.B.E., the present chief commercial officer, who retires on 30th June next. Mr. Lingard, who takes up his appointment on 1st July, was educated at Berkhamsted School and London University and in 1936 he joined the staff of the County of London Electric Supply Co., Ltd. During the last war he served in the Royal Artillery. In 1947 he was appointed area manager of the Lambeth and Camberwell Area, County of London Co. and associated companies, and on the nationalisation of the industry in 1948 he was appointed commercial officer, South Western Sub-Area, London Electricity Board, becoming assistant chief commercial officer in 1953. Since August, 1956, he has held the position of deputy chief commercial officer. Mr.

Mr. P. A. Lingard

Mr. F. C. Fenton

Fenton has been chief commercial officer since nationalisation and was formerly with the County of London group.

Henley Foundries, Ltd. (a subsidiary of W. T. Henley's Telegraph Works Co., Ltd.), has appointed **Mr. F. V. Vaissiere** to the board of the company. Mr. Vaissiere is assistant general manager of W. T. Henley's Telegraph Works Co., with whom he has served for thirty-five years, having been appointed assistant sales manager in 1942, sales manager in 1950, and assistant general manager in 1954. Mr. Vaissiere has been appointed to the board of Henley Foundries to fill the vacancy created by the retirement of **Mr. F. W. M. Anderson,** who had been a director since its acquisition by Henley's in 1945, and who retired from the board of W. T. Henley's Telegraph Works Co. in April last.

Mr. J. Y. Dick, of Oliver Melville & Co., Ltd., Kirkcaldy, Fife, was elected president of the Electrical Contractors' Association of Scotland in succession to **Mr. I. Sclar,** of Glasgow, at the recent annual conference held in North Berwick. The new vice-president is **Mr. A. Robertson,** of Alexander Robertson & Co., Glasgow.

The Eastern Electricity Board has appointed **Mr. R. F. Winder,** at present manager of the Hendon District in the Northmet Sub-Area, to be manager of the Chilterns Sub-Area in place of **Mr. S. F. C. Whitmore,** who was recently appointed a member of the South Western Electricity Board. Educated in Croydon and later at King's School, Canterbury, Mr. Winder's studies were interrupted by the 1914-18 war and he served first in the R.F.C. and later in the R.A.F. as a pilot. After the war he obtained his technical training at Faraday House and from 1923 to 1924 was with W. T. Henley's Telegraph Works Co., Ltd., in the foreign sales department. He later joined the North Metropolitan Power Co., with which company he held various appointments. He became manager of the Eastern Board's Hendon District in 1952.

Mr. R. F. Winder

Mr. G. A. Plummer, M.I.Mech.E., M.I.Mar.E., a main board director of John Thompson, Ltd., since 1955, and a director of the John Thompson Water Tube Boilers Co. for the last twenty years, retired at the end of May, after serving with the John Thompson group for thirty-three years.

Mr. Plummer's first senior appointment was as a deputy director of John Thompson Water Tube Boilers Co. in 1931, since when he has been largely responsible for the research into, and the development of, water tube boiler plant; he has developed more than twenty patents. Much of the development in Britain of La Mont forced circulation and controlled circulation boilers and of the "Etaflo" boiler is attributable to Mr. Plummer. He is a director of La Mont Association, Ltd., and of the La Mont Steam Generator, Ltd., and he is retaining these directorships. More recently he has been engaged in the nuclear power plant division of John Thompson, Ltd., and was closely associated with the production of the stainless steel vessel and the primary and secondary heat exchangers for the Dounreay fast-breeder reactor. Up to the time of his retirement Mr. Plummer was concerned with the design and construction problems presented by the steam raising equipment for the Berkeley nuclear power station. Almost since its inception in 1940, Mr. Plummer has served on the Boiler Availability Committee and he has sat on the Research Committee of the Water Tube Boilermakers' Association since that committee was founded.

Mr. G. A. Plummer

Among the awards of grants by the Paul Instrument Fund Committee is £2,000 to **Dr. H. Motz,** reader in engineering science, University of Oxford (in association with **Professor G. B. Walker,** professor of electrical engineering, Essex College, Assumption University, Windsor, Ontario), for the construction of a linear accelerator working at 1·6 cm (J-band). The Paul Instrument Fund Committee is composed of representatives of the Royal Society, the Physical Society, the Institute of Physics and the Institution of Electrical Engineers, and was set up in 1945 to receive applications from British subjects who are research workers in Great Britain for grants for the design, construction and maintenance of novel, unusual or much improved types of apparatus for investigations in pure or applied physical science.

Mr. G. S. Parish has been appointed sales manager, London area (including the Home and Eastern counties), of the David Brown Corporation (Sales), Ltd. He will be responsible for the sales of gear, foundry, machine tool and precision tool products in those areas and will operate from the London office of the David Brown group, 96-97, Piccadilly, London, W.1. Mr. Parish was previously sales manager of the Motor Gear & Engineering Co., Ltd.

Mr. G. S. Parish

The annual general meeting of the **Ipswich and District Electrical Association** was held at Electric House, Ipswich, on 25th May. Mr. A. White (chairman), in his report, said that the Association had had a most successful year, and membership increased to 160. He referred to the

Mr. A. White, retiring chairman of I.D.E.A., investing the new chairman, Mr. J. A. Robertson, with the chain of office. Also in the photograph is Mr. H. C. Waters, president of the Association

town's lack of facilities to cater for the increasing number of guests, and visitors, who desired to attend the main functions, and regretted that such functions had to be held at venues outside Ipswich; it was hoped that this might be remedied in the future. The officers for the ensuing year are: Chairman, Mr. J. A. Robertson (assistant chief engineer, Bexford, Ltd., Brantham); vice-chairman, Mr. R. L. Thurlow (district manager, Cryselco, Ltd., Bury St. Edmunds); hon. secretary, Mr. W. F. Rowberry (Siemens Edison Swan, Ltd., Ipswich); hon. treasurer, Mr. W. H. Howell (showroom manager, Eastern Electricity Board, Ipswich); hon. publicity and press relations officer, Mr. H. H. Wright (Metropolitan-Vickers Electrical Co., Ltd., Ipswich). Mr. H. C. Waters, J.P., M.I.E.E., F.R.S.A., continues as president for a further year.

The Council of Industrial Design has appointed **Mr. W. H. Mayall** as industrial officer for the engineering industries, in succession to **Mr. L. A. Grosbard,** who has now joined Mullard, Ltd.

The North Eastern Electricity Board has appointed **Mr. C. G. Gilthorpe,** M.A., F.C.I.S., as liaison officer to succeed **Mr. A. H. Kenyon,** M.I.E.E., who recently became deputy chairman of the East Midlands Electricity Board. Mr. Gilthorpe has been assistant secretary (establishments) at the North Eastern Electricity Board's headquarters since November, 1948. He was educated at Chesterfield Grammar School and Brasenose College, Oxford University, and before the war held a number of appointments in education and training. During the war he served as a wing commander in the R.A.F.V.R., both at home and overseas.

Mr. W. J. Dawson, F.A.C.C.A., has been appointed assistant secretary (establishments) in succession to Mr. Gilthorpe. He joined the electricity supply industry in 1924 and served with the Stockport and Scarborough Corporations before vesting date. During the last war he held a commission in the Accountancy Branch of the R.A.F.V.R., rising to the rank of squadron leader. Since vesting day Mr. Dawson has been the accountant of the Board's York Sub-Area.

Crofts Engineers (Holdings), Ltd., announces that **Mr. J. Busfield,** A.C.A., who was recently appointed secretary and chief accountant for Crofts Engineers (Holdings), Ltd., and Crofts (Engineers), Ltd., has been appointed a director of Crofts Engineers (Holdings), Ltd., Crofts (Engineers), Ltd., and J. Parkinson & Son (Shipley), Ltd. He joined Crofts in 1950 as assistant secretary and chief accountant.

Mr. M. T. J. Goff, joint managing director of Crofts (Engineers), Ltd., since 1951, and a director of Crofts Engineers (Holdings), Ltd., since 1954, has also been appointed a director of J. Parkinson & Son (Shipley), Ltd. Mr. Goff is at present in South Africa to review the position of Crofts subsidiaries there.

Mr. J. M. V. Turner, D.F.H., Graduate I.E.E., has been appointed general sales manager of "Diamond H" Switches, Ltd., having joined the company in 1954 as a technical assistant in the research laboratory. Mr. Turner was educated at Berkhamsted School and Faraday House Electrical Engineering College, where he gained his diploma in 1952. He served a graduate apprenticeship with the General Electric Co., Ltd., at Witton Engineering Works. Leaving the G.E.C., he served two years as an electrical officer in the R.N.V.R., H.M.S. *Ocean,* and took part in troop ferrying operations to Cyprus in 1955 and 1956. In 1957 he became assistant to the works manager at "Diamond H" Switches and in 1958 was appointed assistant to the chief engineer. He is the elder son of Mr. C. A. Turner, managing director of the company.

Mr. J. M. V. Turner

Mr. I. H. Gordon has been appointed assistant sales manager of the Cambridge Instrument Co., Ltd., at the company's head office in London. He was previously southern area manager of Land Pyrometers, Ltd., and before that was with Evershed & Vignoles, Ltd.

Mr. E. E. Rosen (Ultra Electric, Ltd.) has been elected chairman of the Radio Industry Council in succession to **Mr. G. Darnley-Smith** (Bush Radio, Ltd.), and **Mr. H. V. Slade** (Garrard Engineering & Manufacturing Co., Ltd.) has been elected vice-chairman, in succession to Mr. Rosen.

The Minister of Power has appointed **Councillor W. G. C. Jackson,** A.M.I.E.E., of Kirbymoorside, Yorks., as deputy chairman of the North Eastern Electricity Consultative Council in succession to **Mr. H. Storry,** D.F.C., who retired from the Council on 31st March last on completion of his term of office.

Mr. H. A. Parrott has taken up an appointment for special duties with the Cables Division of Siemens Edison Swan, Ltd. He will be based at the company's office at 155, Charing Cross Road, London, W.C.2. Mr. Parrott is well known for his contribution to the work of the Cable Makers' Association, with whom he has been for thirty-four years, the last eleven of which were as secretary to the Rubber and Thermoplastic Cable Manufacturers' Association.

Mr. H. A. Parrott

Mr. J. A. Sumner, M.I.E.E., M.I.Mech.E., F.B.I.M., manager of the Norfolk Sub-Area of the Eastern Electricity Board, is retiring at the end of this year, and in our advertisement pages today the Board is advertising for a successor.

Mr. H. Elly has been appointed regional fuel supplies officer of the Eastern, London and South Eastern Region of the C.E.G.B. Since 1955 Mr. Elly has been coal and shipping officer and ash marketing officer in the London Division, having previously been a group accountant since 1948. Before nationalisation he was chief administrative officer and accountant with the High Wycombe electricity undertaking.

Mr. A. Coldwell, A.C.W.A., has been appointed assistant regional accountant (development planning and mechanisation) of the Eastern, London and South Eastern Region. Mr. Coldwell was educated at Dumfries Academy and, after service with a firm of chartered accountants, he was appointed in 1933 to the Internal Audit Department of the County of London Electricity Supply Co., Ltd., later becoming local accountant to the

Sevenoaks, Horley and part-Kent Power Co. area in the County of London group. In 1948 he joined the British Electricity Authority, South Eastern Division, as a section head in the Accountant's Department and last October was appointed senior assistant divisional accountant (acting). Provision has been made in the ultimate regional accountancy organisation for four assistant regional accountants, each covering a distinct field of activity. Mr. Coldwell's appointment is the first of these to be filled.

Mr. K. H. Hughes, Barrister-at-Law, has been appointed assistant regional secretary (administration). In 1948 Mr. Hughes was appointed principal assistant in the South Wales Division of the British Electricity Authority, and for over five years was the section head (administration). He was then awarded one of the first scholarships under the N.J.A.C. Scholarship Scheme. After qualifying as a barrister at the Middle Temple, he returned to the South Wales Division as education and training officer, and in 1956 was appointed establishment officer in the London Division.

After a lifetime of service to W. H. Allen, Sons & Co., Ltd., Bedford, including a period of over fifty years as a director and, since 1928, a deputy chairman of the company, **Mr. H. G. Allen,** M.A. (Cantab.), M.I.C.E., M.I.Mech.E., will retire from that position on the board as from 30th June. The eldest surviving son of Mr. William Henry Allen, who founded the business in 1880, he has played a dominant part in the development of the company. In his younger days he worked in various departments, being particularly concerned with the development of the company's commercial organisation.

Mr. Allen was educated at Westminster School and Trinity College, Cambridge, subsequently obtaining his engineering training at Queens Engineering Works and the Fairfield Shipbuilding & Engineering Co., Ltd., before being appointed to the staff of W. H. Allen, Sons & Co. As a consequence of the wide experience and knowledge he gained of the company's commercial activities, Mr. Allen ultimately became responsible for the commercial side of the organisation at home and overseas. Although he is retiring, he will continue to show a keen interest in the company, and whilst he will remain in London where he has resided for many years, he will be available for advice.

Mr. T. R. Earnshaw, who was recently appointed a director of Ferodo, Ltd., has now taken over full responsibility for export sales following the retirement of **Mr. F. L. Harrap,** M.C., his predecessor as export sales director, on 31st May.

Mr. Earnshaw joined the Turner Brothers Asbestos Co., Ltd., an associated company of Ferodo, Ltd., within the Turner & Newall group, nearly twenty years ago. He was export sales manager there for two years immediately before being appointed a director in January, 1954, of another associated company, Asbestos, Magnesia & Friction Materials, Ltd.

Mr. Harrap joined the company in 1919 as a draughtsman. A year later he was promoted to chief draughtsman and in 1924 was transferred to the Sales Department. He became London manager in 1929 and in 1931 sales manager and assistant to the sales director, with responsibility for home and export sales. Five years later he was made a director with the same executive duties and in 1939 became sales director responsible for both home and export markets. He relinquished his home market responsibilities in 1952 to concentrate on overseas trade, becoming export sales director and a director of Asbestos, Magnesia & Friction Materials, Ltd., India. Later, in 1953, he also became a member of the Advisory Board of Feroda S.A.-Lonas Para Freios, Brazil.

Mr. J. D. Millner, manager of the North London branch of Ferodo, Ltd., has been appointed the company's manager in the Irish Republic, with headquarters in Dublin. He has been succeeded as North London manager by **Mr. W. H. Wyse,** whose place as Sheffield manager has been filled by **Mr. A. Chatterton.**

The annual dinner-dance of the **Incorporated Advertising Managers' Association,** held at Grosvenor House, London, W.1, on 28th May, was again a most enjoyable affair. Mr. E. S. H. Janes (Dunlop Rubber Co.), the president, extended a welcome to the guests, particularly Viscountess Lewisham, the guest of honour. He said that the membership of the Association was now nearing 600; they were again holding a "symposium" this year, at which they hoped to see 400 delegates. Mr. Frank Edwards (Ingersoll, Ltd.), the new president, proposed the toast of the ladies, to which Viscountess Lewisham neatly responded. After dinner there was dancing and an excellent cabaret show and during the evening many prizes were won by lucky members of the company.

Mr. M. J. Digby, a meter reader with the Southern Electricity Board, has been elected Mayor of Brentford and Chiswick.

WILLS

Mr. W. J. Picken, O.B.E., M.I.E.E., technical consultant to the English Electric Valve Co., Ltd., who died on 24th February last, left £29,428 gross (£29,201 net).

Mr. R. H. Briggs, F.I.A.C., for 20 years assistant secretary of the British Electrical and Allied Manufacturers' Association, who died on 2nd August last, left £10,176 gross (£10,061 net).

Mr. F. Collins, electrical engineer and contractor, who died on 14th November last, left £17,406 gross (£16,177 net).

Mr. F. G. Russell, A.M.I.E.E., formerly general manager of the Tata Hydro-Electric Co., Bombay, who died on 1st November last, left personal estate in England and Scotland and abroad valued at £57,144.

Mr. W. Tonkinson, formerly a director and chief engineer of the Electric Construction Co., Ltd., who died on 21st January last, left £12,502 gross (£12,377 net).

Mr. J. W. Dunn, for 43 years associated with E.M.I., Hayes, who died on 24th November last, left £18,192 gross (£18,076 net).

Mr. E. G. Pickering, a joint managing director of Johnson, Matthey & Co., Ltd., who died on 16th September last, left £21,997 gross (£14,290 net).

Mr. B. E. G. Forsling, late manager of the B.T.H. Gas Turbine Engineering Department, who died on 23rd October last, left £9,917 gross (£9,847 net).

Mr. H. Oswald, M.I.E.E., late managing director of British Brown-Boveri, Ltd., who died on 8th January, left estate in Great Britain valued at £14,977 gross (£13,203 net).

ELECTRICITY SUPPLY CONFERENCE

On Monday last the customary pre-Convention electricity supply conference took place at Torquay. There was a large representation of all sections of the supply industry and Sir Henry Self (chairman, Electricity Council) presided. Three papers were presented: Sir Josiah Eccles (deputy chairman, Electricity Council) dealt with research and planning in electricity supply; Mr. Ernest Long (member, Central Electricity Generating Board) spoke on the finances of the industry; and Mr. W. S. Lewis (chairman, Midlands Electricity Board) expressed the views of the Area Electricity Boards on a number of aspects. Speakers in a brief discussion were Sir Isaac Hayward (chairman, London Electricity Consultative Council), Mr. J. B. Jackson (C.E.G.B.), Mr. F. Kenyon (chairman, North Western Electricity Consultative Council) and Mr. J. A. Duncan (Merseyside and North Wales Electricity Board). A vote of thanks to the speakers was moved by Sir John Pickles (chairman, South of Scotland Electricity Board).

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Monday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £241 10s 0d
Fire Refined 99·70%	ton £240 0s 0d
Fire Refined 99·50%	ton £239 0s 0d
COPPER Tubes ..	lb 2s 4d
Sheet	ton £268 15s 0d
H.C. wire and strip..	ton £291 15s 0d
LEAD, English ..	ton £69 15s 0d
Foreign	ton £68 0s 0d
MERCURY	flask £77 10s 0d
TIN, block (English) ..	ton £785 10s 0d
ZINC, G.O.B. Foreign	ton £77 10s 0d
BRASS Tubes (solid drawn)	lb 1s 10½d
Wire	lb 2s 8½d
PHOSPHOR BRONZE Wire	lb 4s 1½d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 28½d—28¾d

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

More Socket-Outlets

RECOMMENDATIONS notwithstanding, it is still unusual to find sufficient socket-outlets or "points" in any room of a house; most architects and builders save a few pounds on a house in this way. In very many cases the occupier immediately buys adaptors of various forms so that one "point" can serve two or more appliances simultaneously. The saving in first cost is thus cancelled by the cost of the unsightly and often unsatisfactory adaptors. It is not widely realised that with modern ring circuits the 13 A plugs and socket-outlets double the number of points can be obtained for a cost of only a few shillings per point, not double the total wiring cost, by employing the twin- or two-gang 13 A socket-outlet now made by several firms. In this way two adjacent socket-outlets are provided with no extra cable and installation cost, only the extra for the twin unit, which costs about double the normal type. They may or may not have switches, as required, and they may be surface or flush mounted.

Some contractors have the mistaken idea that such a twin point counts as one point on the ring and one spur, thus limiting the number that may be installed within the letter of the Regulations. This is not the case: the I.E.E. has ruled that no spur is involved. A campaign for more twin socket-outlets by the various makers might do much good to the community at large, both by increasing the usefulness of electrical appliances and by the reduction of possibly dangerous adaptors. Contractors, too, might help by advising customers.

Sevenoaks, Kent. E. H. W. BANNER.

The Electric Runabout's Scope

MAY I add my comments to those of Mr. R. D. Reynolds in your issue of 22nd May regarding "Reflector's" views on the electric runabout?

Surely the greatest potential market for such a car would be amongst city "commuters," especially those in the lower income brackets who are becoming alarmed at the continuous increase of rail fares. Already many employers have found it necessary to provide parking facilities for staff and they should find no difficulty in adding battery charging facilities, to the cost of which it would be reasonable for the "electric commuter" to subscribe. In any case, an electric vehicle with a range of only sixty miles, with home charging facilities, would meet the requirements of the majority.

Furthermore, the driving of an electric vehicle in rush hour traffic, during the commuter's "mobile overtime," would reduce fatigue to a level experienced only by those driving the more expensive of petrol-propelled cars.

With a little imaginative co-operation from the Chancellor of the Exchequer, the electric car could now become the economy car.

Woolwich, S.E.18. S. C. MACDONALD.

Coal Consumption Declines

AFTER a period of pressing demand for coal, a significant surplus of some grades began to develop in 1957 and at the end of that year stocks at collieries and open-cast sites stood at 8·6 million tons. In its report for 1958 just published (H.M. Stationery Office, price 3s 6d) the National Coal Board shows that this trend has continued, total inland consumption and exports declining during the year by 13 million tons to 208 million tons. At 31st December last the Board held stocks of nearly 20 million tons, equivalent to almost five weeks' output.

To reduce output without raising costs or jeopardising future productive capacity, the Board decided to restrict recruitment, Saturday working was suspended, overtime working restricted and the closure dates of twelve pits rapidly approaching exhaustion were brought forward. The total output for the year was 215·8 million tons, including 14·3 million tons from open-cast working. Output of deep-mined coal was 8·6 million tons less than in 1957. Average colliery manpower, at 698,800, was 22,600 below the figure for the previous year. Productivity was the highest ever recorded at 791 man-shifts per 1,000 tons and the loss of 1·5 million tons through unofficial stoppages, etc., was the lowest since 1953.

The output of power-loaded coal rose by 10 million tons to 66 million tons (pithead output), or 28 per cent of the total. At power-loaded faces, only 165 man-shifts were required, on average, per 1,000 tons compared with 170 in 1957. These results, the Board says, were achieved by a selective and more efficient use of machines. A vigorous programme of experimental and development work is in progress to increase the amount of large coal produced by the Anderton shearer loader, which accounts for over 40 per cent of the total mechanised output. Measures taken during the year to halt the downward trend in the proportion of large coal mined included the redeployment and technical improvement of power-loading machines and the extended use of methods employing compressed air to break down the coal, as an alternative to the use of explosives.

At the beginning of the year it was feared that a loss of the order of £30 million might be incurred, but the measures taken to raise efficiency and lower costs proved increasingly successful. The actual loss for the year, before taking credit for taxation provisions no longer required, was £13·4 million, the net loss being £3·5 million. Capital expenditure amounted to £104 million, an increase of £1 million on 1957. Since 1947 a total of £765 million has been spent, including £269 million on major schemes of reconstruction, new sinkings and other colliery schemes.

During 1959, it is proposed to reduce open-cast output by three million tons (about 25 per cent), close 36 collieries in addition to those that would be shut down normally through exhaustion of reserves, and to pursue a policy of greater concentration of production by the elimination of high-cost faces.

Financial Section

STOCKS and SHARES

INDUSTRIAL share prices broke all records during the past month, and the Stock Exchange entered June with investment and speculative business still running at a very high rate. Much of the activity has been revolving around individual issues or sections of the market. The bid for Watney shares is only one spectacular example of the many "take-over" propositions which lift one share or another into special prominence and which tend to encourage the circulation of tips and rumours about other likely candidates for attention. In that respect a good deal of present buying is undoubtedly suspect, but the main stream of investment is still thought to be directed by considered opinions about the generally favourable outlook for industrial securities.

Market Features

In the electrical markets, there has been little in the nature of "take-over" excitement since the re-grouping operations carried out, mainly by means of share-exchange offers, within the cable manufacturing industry. Nevertheless the market has been far from lacking in incident during the past week. Domestic equipment issues have been particularly to the fore under the lead of Hoover, which rose 4s 6d to 70s 6d. Morphy-Richards added a shilling to a previous gain of 1s 9d, reaching 26s. Vactric went rapidly ahead to 46s 6d; the company's financial year ended in March and the results are due this month. There was a further gain of as much as 11s 3d in International Computers & Tabulators to 90s, and Philips Lamps advanced by almost as much to 128s 9d, after evidence of the company's continued expansion in the first quarterly progress report of the year. Having risen earlier by 11s on the strength of the annual results, Ever Ready were marked up a further 1s 6d to 40s 6d.

Electrical Equipment

English Electric shares were quoted ex the 50 per cent scrip issue at the beginning of this week, and were firmly supported at around 45s 6d in the new form. Reyrolle, Parsons and Crompton Parkinson also reflected a steady investment demand. Head Wrightson, at 28s 6d, and Richardsons, Westgarth at 15s 3d continued to register satisfaction with the annual results reported earlier, but Thornycroft at 23s were under the influence of the company's decision to pass the interim dividend on account of the present year. There is a jump of 6s 3d to 32s 6d in the shares of Bakelite, the controlling interest in which is in America. De La Rue, with the final dividend declaration expected on 10th June, were good at 38s 6d, and Pye were given strong support which raised the price 1s 9d to 17s 9d.

Plessey Issue

Plessey 10s shares are now quoted ex the scrip issue, as a result of which holders receive two new 10s shares for every one previously held. The shares have been in good demand since the issue; at 33s 6d they showed an improvement equivalent to about 3s on the previous quotation. The new shares stand at about the same price, being transferable free of stamp duty, but not ranking for the interim dividend of 18 per cent which the directors intend to pay on account of the financial year ending with this month. They will participate in the final distribution, and equally with the old shares in all other respects. For the last three years Plessey have paid dividends of 30 per cent, divided equally between interim and final payments. Whether the latest declaration indicates an increase in the equivalent rate of 10 per cent on the increased capital remains to be seen. It is the company's intention to issue further shares for cash, on a "rights" basis, before long.

Cable Results

After some fluctuation, Johnson & Phillips £1 shares were little altered on balance, at 26s 3d, following the preliminary statement on the results for 1958, showing a contraction of profits from £91,000 to £74,000. The dividend is repeated at the rate of 5 per cent to which it was reduced a year ago, and gives a yield of a little over 3¾ per cent on the shares at their present price. Reliance-Clifton Cables are also paying the same dividend as before, of 15 per cent, but are distributing an extra 3½ per cent from capital profits. Group profits, after tax, are one third higher than the previous year's and give almost fivefold cover for the dividend. At 18s 9d the 5s shares offer a return of approximately 4 per cent.

Telegraph Condenser

Telegraph Condenser is among the companies which have reported benefits from the relaxation of hire-purchase restrictions. At last month's annual meeting the chairman said the results had been seen in increased demands for components used in radio and television sets as well as in domestic appliances. Since the beginning of the current year there had been no noticeable slackening in demand, and a high level of production had been maintained in most departments. Profits in 1958 improved by more than 40 per cent, to £187,000 after tax. The dividend was maintained at a total of 25 per cent for the fifth year in succession and was covered twice by available earnings. At 43s 9d the 10s shares offer a yield of 5¼ per cent.

Company News

Telephone Manufacturing 5s shares have been better, at a little over 6s, since the publication of the annual results: net profits were reduced but the dividend is maintained at 10 per cent. Profits of Heatrae were halved last year, but here also there is no change in the dividend rate, at 20 per cent. Having been advanced to 10s before the announcement, the 2s shares came back initially to 7s but recovered to 8s 3d. Taylor Tunnicliff were not much altered at 22s 9d after the receipt of details for the merger of the company with Bullers. Enfield Cable shareholders now have the formal share-exchange offer from Enfield Rolling Mills: the directors have recommended acceptance of the proposal, which is open until 10th June, subject to extension. The 4s shares of Kango Electric Hammers, which recently held the annual meeting, have been quoted at around 8s to yield 6¼ per cent on the dividend of 12½ per cent.

British Guiana Telephone System

An installation team recently arrived in Georgetown, British Guiana, to install cables in connection with the modernisation of the telephone system. For many years the telephone distribution system has been carried on overhead lines and these are now being replaced by underground cables. W. T. Henley's Telegraph Works Co., Ltd., is carrying out the contract, which was awarded to the company by the Crown Agents on behalf of the Post Office Telecommunications of British Guiana, for the supply and installation, including jointing and testing of the complete underground cabling requirements for the City of Georgetown. The consultants are Messrs. Preece, Cardew & Rider.

Some forty-three miles of cable has already been delivered to Georgetown where the underground duct system has been prepared for the insertion of the cables. The larger cables contain up to 1,200 pairs of wires and an interesting feature of the design of all the cables is the special covering of p.v.c. which has been applied over the lead sheath as a protection against the possibility of corrosion. This is a necessary precaution as Georgetown lies below sea level.

The Post Office Telecommunications of British Guiana are building a new automatic telephone exchange to complete the modernisation programme.

REPORTS and DIVIDENDS

Simon-Carves, Ltd.—The report and accounts for 1958 now issued confirm the preliminary figures given in our issue of 1st May.

In his review of the year, which accompanies the report and accounts, Mr. R. B. Potter (chairman) says that the consolidated net profit of £1,461,814, before taxation, is once more a record. The transfer of £100,000 to nuclear development reserve brings the total of this reserve to £400,000; this is intended to be available for any unforeseen expenditure which might arise in this field. The appropriation is over and above the actual expenditure during the year on research and development, particularly for nuclear power, all of which has been charged in the accounts. Towards the end of the year all the shares in Lodge-Cottrell, Ltd., were purchased.

Once more the turnover showed an impressive increase almost entirely related to work on contracts obtained in previous years. Although the order book is lower than a year ago, it is anticipated that the turnover and results of 1959 should not differ materially from those of 1958. The more distant future is problematical, but even so for a number of years the present uncompleted contracts will make an important contribution towards the profits.

In heavy engineering generally 1958 presented many problems. Although all departments were busy the amount of new work obtained was disappointingly low. Owing to the credit squeeze and the dearness of money there were relatively few capital projects in this country, and in particular the steel industry, the National Coal Board and the C.E.G.B. cut back their capital expenditure programmes; the same influences affected private industry. Overseas competition was fiercer and forced margins to be reduced.

There are now signs that the position may be improving, and Mr. Potter anticipates the resumption of capital expenditure in the steel industry and certain of the nationalised industries. Intense competition must still be expected, which will mean lower margins, but which he hopes to some extent will be countered by increased efficiency. In export markets they are at present negotiating projects in Argentina, Brazil, Ceylon, Portugal and the United States, apart from countries in the Commonwealth.

Turning to the activities of the various departments, Mr. Potter says that although the Power Plant Department has been heavily engaged on large boiler contracts for the C.E.G.B. and industry, its future gives the most cause for concern. At home there is undoubtedly an excess capacity in the boilermaking industry, particularly now that the C.E.G.B. has cut back its programme for new stations, the policy being to concentrate on fewer but larger stations. The position is bound to be further aggravated in the future by the gradual switching to nuclear power production. Abroad the picture is no brighter, for intense competition is encountered not only from other British boilermakers but also from European, Japanese and American companies. Whilst they should be successful in obtaining a number of orders for small industrial boilers, they require each year either a large C.E.G.B. contract or a large overseas one in order to maintain the expected profitability of the department.

The problem is closely associated with the Nuclear Power Division, which has been busy on the contract for the South of Scotland Electricity Board at Hunterston; this is being carried out in association with the General Electric Co., Ltd. One encouraging development is the news that the G.E.C./Simon-Carves group is likely to obtain a nuclear power station contract in Japan. A letter of intent has now been received by the G.E.C. and the final contract is expected to be signed at the end of June. Mr. Potter's main concern with nuclear power is that, along with the other groups, they are spending exceptional sums on research and development with no real assurance of proper continuity of work in the future. The C.E.G.B. programme for nuclear power stations has been drastically reduced, yet at the same time a fifth group has been formed. The position is no brighter on the export side, as there is no evidence that foreign countries are ready to place orders regularly with this country. Indeed, in Europe there are indications that a number of contracts will go to America, apparently because of the more attractive terms which are being offered both for credit and sale/re-purchase of fuel elements.

The directors are giving careful thought to future policy. It may be necessary to review certain of their traditional lines of business and at the same time to explore new fields, whilst the organisation is being investigated with a view to greater efficiency and economy.

Proposed J. & E. Hall–Thermotank Merger.—It is announced that J. & E. Hall, Ltd., and Thermotank, Ltd., propose to amalgamate. The new company would be known as Hall-Thermotank, Ltd.

An extraordinary general meeting of stockholders of J. & E. Hall, Ltd., is being held on 22nd June, when they will be asked to approve the necessary resolution for the merger. The effect of the amalgamation will be that the present shareholders of J. & E. Hall, Ltd., will hold 66⅔ per cent of the ordinary shares of the new group and the former shareholders of Thermotank 33⅓ per cent. The Peninsular & Oriental Steam Navigation Co. at present holds 52·3 per cent of the voting control of J. & E. Hall, Ltd. After the merger, the P. & O.'s interest in the new group would be 35·1 per cent.

Lord Dudley Gordon (chairman, J. & E. Hall, Ltd.) will be president of Hall-Thermotank, Ltd. The chairman will be Mr. I. M. Stewart (chairman, Thermotank, Ltd.) and the deputy chairman Mr. J. F. E. d'A. Willis (director, J. & E. Hall, Ltd.). The other directors will be Messrs. J. D. Farmer, A. Greenfield (joint managing directors, J. & E. Hall, Ltd.), W. S. Hayes (director, J. & E. Hall, Ltd.), F. McPherson and J. K. W. MacVicar (joint managing directors, Thermotank, Ltd.).

An offer is being made on behalf of the new organisation to the shareholders of Vent-Axia, Ltd., to acquire all the ordinary stock of Vent-Axia, Ltd., at a price of 10s 6d per unit. The board of Vent-Axia recommends its acceptance, and if the offer is accepted, Mr. J. C. Akester, chairman and managing director of Vent-Axia, Ltd., will join the board of Hall-Thermotank, Ltd.

Laurence, Scott & Electromotors, Ltd.—The annual meeting was held on 27th May, Mr. G. H. Wilson (chairman) presiding. In his review of the year, which had been previously circulated, Mr. Wilson said that most of the departments had been engaged to their maximum capacity and the turnover was slightly greater than the year before. During 1958 they were glad of the very large volume of orders that they had in hand, as there was a substantial fall in new orders. During the year cancellations at British shipyards almost equalled the new tonnage ordered, which was about 30 per cent of the year before. This had affected their order book, but much less so than would have been the case in the earlier days of the company's history, when almost all their activities were concentrated in this field. Since the end of the war they had been actively pursuing a policy of diversification.

In the industrial field there were many major schemes under consideration. Some large industrial orders had been received since the turn of the year, so that the total order book was still large, even though it was not so well balanced as had previously been the case. Present indications were that some departments would not be operating to their full capacity during the current year, while others would be overloaded. The reduction of the arrears, coupled with the greatly improved availability of raw materials, had had the effect of enabling them to quote quicker deliveries than at any time since the war.

Referring to the trend of legislation for abolishing trading arrangements, Mr. Wilson said that whilst unrestricted competition was the best

spur to progress, it could become undesirable if it reached a stage where such things as technical education, research and development could no longer be fully sustained. An industry with a good export record could easily be adversely affected by an internal price war.

Turning to plant modernisation, he said that their anticipated capital commitments amounted to £280,000. Regarding future prospects, they had a number of long-term contracts yet to be completed, and they had great confidence in the future of the industry. In the middle distance the position was less clear and the extent to which they would be affected by the recession depended on the success of the efforts now being made to revive capital investment. The past year marked the company's seventy-fifth anniversary and to commemorate the event the directors were making a gift of £10 to each employee aged twenty-one and over on the payroll and who was in the employ of the company at 1st January, 1958.

Hopkinsons, Ltd. — The annual meeting was held on 28th May, Mr. R. L. Brown (chairman) presiding. In the report for 1958, the company says that development work on new products to meet the requirements of nuclear power stations has been responsible for increased charges, but this expenditure should produce beneficial results in the future. The value of orders received for home trade has shown some reduction as a result of the general recession in industry, but this recession has enabled them to reduce their arrears of orders. Outstanding orders today will ensure full capacity during the current year. Export orders have been fully maintained and deliveries to export markets show a considerable increase. The new heavy machining and fitting shop is now in production enabling them to meet the requirements for large bore "Transphere" valves for reactors of nuclear power stations, and they have received an order for this type of valve for the Latina nuclear power station in Italy. Orders received by Fielden Electronics, Ltd., are showing an upward trend and development and production of new manufactures is being maintained.

Anglo-Portuguese Telephone Co., Ltd.—The annual meeting will be held on 10th June. In his review of the year, which has been circulated to stockholders, Sir Alexander Roger (chairman) says that the company has been working throughout 1958 against a background of shrinking demand and intensive competition. During the year the average rate of applications for telephone service in the Lisbon and Oporto areas was 1,825 per month. At 31st December last the total number of stations was 229,891, a net increase of 20,398 during the year; the waiting list has been reduced to slightly below 6,000. A notable undertaking during the year was the installation of a radio link between Graca on the north bank of the River Tagus and Montijo on the south bank.

Referring to the British Trade Fair now being held in Lisbon, Sir Alexander expresses the hope that it will restore Britain to her traditional premier position in Portuguese trade. Their company's contribution to Anglo-Portuguese trade is an important one. Last year they shipped to Portugal plant and equipment to the value of £995,000, bringing the total over the past ten years to £6,135,000. Materials purchased in Portugal last year amounted to £520,782, the total over the last ten years being £3,131,000.

Harland Engineering Co., Ltd.—The report and accounts now issued confirm the preliminary figures given in our issue of 24th April. In his statement Mr. H. Cowan-Douglas (chairman) says that invoiced sales of the parent company and Harland Drives, Ltd., taken together amount to £2,650,000, a slight improvement on the previous year. The group order intake at approximately £3,100,000 constitutes a record and orders in hand at approximately £4,507,000 show an increase of about £500,000 over the previous year.

Both the electrical and hydraulic products continue to be in heavy demand. They have received important contracts at home and overseas for boiler feed pumps, complete waterworks installations, and Government projects, including an order from Canada for the boiler feed pumps for one of the largest thermal power stations on the American Continent, and valuable orders for water turbines for installation in Australia, Iran and the United Kingdom. They are in close contact with nuclear development and valuable contracts for plant serving various types of reactors are under execution. During 1958 the first unit of still larger sizes of boiler feed pumps and driving motors were built, successfully tested and commissioned for new major thermal power stations of the Central Electricity Generating Board. The intake of orders on contract works is being well maintained. After dealing with the subsidiary and associated companies, Mr. Cowan-Douglas refers to the research and development programme and says they have stepped up expenditure in this field to keep abreast of the rapid advance which is occurring throughout the world in electronic and nuclear engineering and in metallurgy.

Superheater Co., Ltd.—Mr. E. A. Robinson (chairman and managing director) presided at the annual meeting held on 28th May. The directors, in their report of 1958, stated that the increase in the trading balance was largely due to much greater output at the Trafford Park Works where full production was maintained throughout the year. There was a slight falling off in orders received in the last few months of the year, particularly in the Locomotive Division; for the first time for many years output exceeded new orders. Nevertheless the balance of orders on hand at the beginning of the current year was still considerable and since then further substantial contracts in the Power Plant Division had been, or shortly would be, received. Exports continued at a high level. The Nuclear Energy Division had been further expanded and considerable research and development work undertaken in close contact with their associates abroad.

Radiation, Ltd.—The annual meeting was held on 28th May, Mr. W. D. King (chairman) presiding. In the course of his review of 1958, which had been previously circulated, the chairman referred to the merger with Parnall (Yate), Ltd., and said this had widened the group's interests and brought them into the electrical appliance field, home laundry appliances and electric lamps. In the Electrical Division they had formed one selling organisation known as Electrical Division of Radiation, Ltd., to market the products manufactured under the Parnall and Jackson trade marks. Two new products had been launched in 1959, the first domestic refrigerator with an all-plastic body and a new type of vacuum cleaner. Shipments overseas were approximately the same as in 1957, but import restrictions in New Zealand would prevent them maintaining this volume in 1959. They hoped to counteract this by some local manufacture.

With the removal of restrictions, trade in the first quarter of the current year had increased substantially over that for 1958.

The Telephone Manufacturing Co., Ltd.—A group profit of £67,316 is reported for 1958, as compared with £93,894 for 1957. This figure is struck after providing £59,059 for taxation, and crediting adjustment on revision of prices on contracts in respect of previous years amounting to £12,470. The profit attributable to the holding company is £61,890. The dividend for the year is maintained at 10 per cent by a final payment of 7½ per cent.

The Plessey Co., Ltd., has announced an interim dividend of 18 per cent (against 15 per cent). It has also announced that at an extraordinary general meeting held on 26th May it was agreed to increase the capital from £3,450,000 to £7,750,000 by the creation of a further 8,600,000 ordinary shares of 10s each, and to capitalise reserves of £2,400,000 by allotting two 10s ordinary shares for each existing ordinary share.

Vent-Axia, Ltd.—The group profit for the year to 31st March last is £227,724, as compared with £290,613 for 1957-58. From this are deducted taxation of £104,970 and share and loan capital expenses, etc., of £2,363. Capital redemption reserve receives

£1,868 and general reserve £80,000. It is proposed to pay a second interim dividend of 30 per cent, making 40 per cent for the year. The total for the previous year was 35 per cent. The balance carried forward is £11,143 (against £16,455 brought in).

Ever Ready (Ireland), Ltd.—The profit for the year to 31st March last was £17,753, as compared with £14,901 for 1957-58. It is proposed to pay an ordinary dividend of 12½ per cent for the year (same), a bonus of 2½ per cent (same) and a jubilee bonus of 5 per cent (nil). The balance carried forward is £9,078 (against £9,024 brought in).

Johnson & Phillips, Ltd., report that after providing £32,000 (against £98,000) for taxation, the net profit for 1958 is £73,676, as compared with £91,245 for 1957. The dividend for the year is maintained at 5 per cent.

Heatrae, Ltd., reports that after providing £13,500 for taxation, the net profits for the year to 28th February last are £15,156, as compared with £30,377 for the preceding year. The dividend for the year is unchanged at 20 per cent.

Crompton Parkinson, Ltd., have declared an interim ordinary dividend of 5 per cent (unchanged).

Turner and Newall, Ltd., are paying an interim dividend of 5 per cent (unchanged).

New Companies

Allied Insulators, Ltd.—Registered 7th May. Capital £100. To acquire for the purpose of amalgamation (1) the whole or any part of the issued share capitals of Bullers, Ltd., and (2) the whole or any part of the assets and undertaking or the issued share capital of Taylor Tunnicliff (Electrical Industries), Ltd., and to carry on the business of manufacturers of and dealers in insulators of all kinds whether made of pottery, porcelain, plastics, glass, rubber or any other substance, etc. Regd. office: Leek Road, Milton, Stoke-on-Trent.

British Sealed Beams, Ltd.—Registered 15th May. Capital £1,000,000. Manufacturers of and dealers in electrical and lighting plant and machinery, lamps, fittings and apparatus, etc. Solicitor: G. C. Bodington, 33, Grosvenor Place, S.W.1. (Fuller particulars were given in our last issue, page 1019.)

Savage Transformers, Ltd.—Registered 19th May. Capital £30,000. Manufacturers of and dealers in electrical, electronic and mechanical apparatus and accessories and components of all kinds, etc. Directors: W. B. Savage and Jeanne L. Savage. Regd. office: Nursteed Road, Devizes, Wilts.

R. J. E. Platt (Electrical), Ltd.—Registered 8th May. Capital £1,000. Factors of, agents for and wholesale and retail dealers in and repairers and service engineers in radio and television apparatus, washing machines, refrigerators, electrical heating apparatus, etc. Directors: R. J. E. Platt and Dorothy B. Platt. Regd. office: West Street, Marlow, Bucks.

Cornfield & Aldridge, Ltd.—Registered 28th April. Capital £20,000. To acquire the business of electrical conduit fittings manufacturers carried on by Charlotte Cornfield, F. I. Holford, Dorothy A. Holford and K. W. Cornfield at Spout Lane, Walsall, as Cornfield & Aldridge. Directors: Charlotte Cornfield, F. I. Holford, Mrs. Dorothy A. Holford and K. W. Cornfield. Regd. office: 19, Spout Lane, Walsall.

Elliott Brothers Sales Agencies, Ltd.—Registered 15th April. Capital £100. To sell, install, assemble, service, maintain, repair, manufacture and deal in instrumentation and articles of all kinds in connection with the control, operation and indication by electronic, electrical, mechanical, pneumatic and other means of manufacturing processes, etc. Directors: E. O. Herzfeld, L. L. Ross and G. C. Fairbanks, directors of Elliott Brothers (London), Ltd., etc. Regd. office: Century Works, Lewisham, S.E.13.

Rutherford & Walker, Ltd.—Registered 22nd April. Capital £1,000. Electricians, radio and television engineers, etc. Directors: S. J. Rutherford and P. O. E. Walker. Regd. office: 8, Burton Road, Carlton, Nottingham.

J. Bull Electrical, Ltd.—Registered 21st April. Capital £100. Manufacturers of and dealers in all kinds of domestic appliances, etc. J. Bull is the first director. Regd. office: 66, Grove Road, Eastbourne.

Newtronic, Ltd.—Registered 28th April. Capital £1,000. Distributors and dealers in, manufacturers, repairers and cleaners of domestic appliances, etc. Directors: Doris Citron and Gerald Citron. Regd. office: 5, Norfolk Street, Manchester, 2.

Philan, Ltd.—Registered 13th April. Capital £1,000. Electrical goods of all kinds, etc. Directors: G. D. Gilbert and A. L. Leeson. Regd. office: Rockstone Works, Doman Road, Camberley, Surrey.

Worster & Hounslow, Ltd.—Registered 17th April. Capital £1,000. Electrical equipment specialists, etc. Directors: F. M. Gatrill and A. J. Gatrill. Regd. office: 14, Bryanston Street, W.1.

Geoffrey's (Electrical), Ltd.—Registered 15th April. Capital £100. Television, radio and electrical engineers and contractors, etc. Directors: G. Quintaba and Mrs. Pauline J. Quintaba. Regd. office: 45, York Road, Ilford, Essex.

Electrical Illuminating Co., Ltd.—Registered 15th April. Capital £1,700. To acquire the business of electrical engineers and contractors carried on by W. Thompson and J. Kelly at Carlisle, etc. Directors: W. Thompson and J. Kelly. Regd. office: 15, Friars Court, Carlisle.

Bullmans of Coventry, Ltd.—Registered 15th April. Capital £5,000. Television, radio and electrical engineers and contractors, etc. Directors: G. J. Bullman (permanent) and Ida Bullman. Regd. office: 646, Foleshill Road, Coventry.

Douglas A. K. Clarke, Ltd.—Registered 16th April. Capital £1,000. To acquire the business of a refrigeration and electrical engineer heretofore carried on by D. A. K. Clarke at Crookesmoor Road, Sheffield. Directors: D. A. K. Clarke and Mrs. Ivy J. Clarke. Regd. office: Warrington House, 224, Crookesmoor Road, Sheffield, 10.

Hobson & Hammond (Electrical), Ltd.—Registered 31st March. Capital £1,500. To acquire the business of electrical engineers and contractors carried on by A. E. Hobson and F. R. Hammond at Sheffield and Grimsby as Hobson & Hammond, etc. Directors: A. E. Hobson, Mrs. Joyce Hobson, F. R. Hammond and Mrs. Joan Hammond. Regd. office: 813/815, Attercliffe Road, Sheffield.

West Midlands Electrical Installations, Ltd.—Registered 6th April. Capital £3,000. To acquire the business of electrical engineers heretofore carried on by T. Barrow and B. C. Sparks at 17, Maylord Street, Hereford. Directors: T. Barrow, Mrs. Betty Barrow, B. C. Sparks and Mrs. Gillian Sparks. Regd. office: 34, Castle Street, Hereford.

E. Emery & Sons, Ltd.—Registered 6th April. Capital £5,000. Electrical equipment specialists, etc. Directors: E. S. Emery and J. G. Emery. Regd. office: 111, London Road, Sawbridgeworth, Herts.

Capital Domestic Appliances, Ltd.—Registered 6th April. Capital £1,000. Manufacturers and repairers of and dealers in artificial lighting apparatus, electrical fittings, appliances and accessories, etc. Solicitors: Ellis Shieldhouse & Co., Epsom.

D. Heaton (Electrical), Ltd.—Registered 31st March. Capital £5,000. To acquire the business of a radio, television and electrical dealer carried on by D. Heaton, at 13, Makinson Arcade, Wigan, and 107/111, Ormskirk Road, Newtown, Wigan, as D. Heaton, etc. Directors: D. Heaton and Mrs. Mary L. O. Heaton. Regd. office: 13, Makinson Arcade, Wigan.

Bennett's Electrical Appliances, Ltd.—Registered 31st March. Capital £1,000. Retail dealers in domestic electrical appliances, etc. Directors: H. Bennett and J. Owen. Regd. office: 11, Market Street, Eastleigh, Hants.

Constant Controls, Ltd.—Registered 6th April. Capital £100. Electricians, mechanical engineers and manufacturers of and dealers in electrical apparatus and goods, etc. Directors: S. A. Talbot and W. J. Whaley. Regd. office: 103, Berrylands, Surbiton Hill, Surrey.

Hadley Electrical & Engineering Supplies Co., Ltd.—Registered 26th March. Capital £500. To acquire the goodwill of the business of Hadley Electrical & Engineering Supplies Co., carried on at 58, James Street, Docks, Cardiff, etc. Directors: H. W. Day and C. F. Heald. Regd. office: 58, James Street, Docks, Cardiff.

E. G. Webb & Son, Ltd.—Registered 1st April. Capital £5,000. To acquire the business of electrical engineers and contractors carried on at Adeyfield, Herts, as E. G. Webb & Son, etc. Directors: E. G. Webb, Mary Webb, B. Webb and G. F. Barnes. Regd. office: 4, Hammer Lane, Adeyfield, Hemel Hempstead, Herts.

Frederick Beck, Ltd.—Registered 1st April. Capital £5,000. Electrical, electronic, radio and mechanical engineers, etc. Directors: A. W. Catt and Winifred G. Catt. Regd. office: 22-26, Camden Passage, N.1.

James & Bentley (Electrical), Ltd.—Registered 1st April. Capital £20,000. Electrical engineers, manufacturers of television apparatus, etc. Directors: G. T. James and W. J. Bentley. Solicitors: Williams & Cole, Walsall.

Domestic Installation & Supplies (James Bridge), Ltd.—Registered 31st March. Capital £1,500. Electrical engineers and general electrical installation contractors, etc. Directors: J. L. Corbett, Mrs. Mary E. Haines Corbett and D. B. Corbett. Regd. office: 59, Pinfold Street, Darlaston, Staffs.

Increases of Capital

Hartley Electromotives, Ltd.—Increased by £25,000 in 1s ordinary shares, beyond the registered capital of £55,000.

Herbert Smith Smithlite, Ltd.—Increased by £20,000 in £1 ordinary shares, beyond the registered capital of £10,000.

Bankruptcies

E. G. Phillips, electrical engineer, 39, Carrs Lane, Birmingham, 4.—Trustee, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3, released 10th April.

F. Monk, Ashby Road, Stapleton, Leics., electrical and radio engineer.—First and final dividend of 5 15/32d in the £, payable at the Official Receiver's office, 27, Regent Street, Park Row, Birmingham.

R. R. S. Richards, 4, Mount Street, Wrexham, Denbighshire, electrical and radio engineer.—Trustee, Mr. W. Morgan, Elwy House, King Street, Wrexham, appointed 20th May.

G. Dickinson and **K. G. Dickinson,** trading as G. & K. G. Dickinson at 134, Clipsley Lane, and 321, Church Road, Haydock, Lancs., electricians.—First dividend of 13s 4d in the £, payable on and after 24th June at 5, Rumford Place, Liverpool, 3.

C. A. Norwood, lately residing and carrying on business at 38, Thornbury Road, London, S.W.2, as an electrical contractor.—First dividend of 6d in the £, payable on and after 12th June at 58-61, York Terrace, Regent's Park, London, N.W.1.

W. H. Lawrence, 30, Radlett Road, Frogmore, near St. Albans, electrician, lately carrying on business in the name of Home Maintenance (Electrical) Service at 342, St. Albans Road, Watford, Herts., formerly in partnership with others but now on his own account.—Receiving order made 5th May on debtor's own petition. Public examination 8th July at the Town Hall, St. Albans, Herts.

DOMESTIC ELECTRICAL EQUIPMENT

ELECTRIC IRONS

IT is estimated that electric irons are used in over 90 per cent of the total number of homes wired for electricity in this country. With their coloured, anodised or chromium plated finishes, modern electric irons are attractive items of domestic equipment and, being virtually trouble free, they give years of satisfactory service. It may well be that for these reasons their general styling and arrangement has changed little in recent years and manufacturers understandably seem content to continue to produce similar models. Of the two dozen or so manufacturers listed in the following survey, the majority produce more than one design in their respective ranges, including automatic, non-automatic, and travelling irons. Undoubtedly, the most popular of these is the automatic type, which incorporates a bi-metal thermostat controlled by a heat regulator and, in most cases, a pilot light.

Another useful type is the steam iron which eliminates the need for damping-down clothes before ironing. This type of iron can, of course, also be used "dry" as an ordinary iron. In addition to Hoover and Morphy-Richards a third manufacturer has now entered the field, namely, Best Products, Ltd., with the new "Steam-O-Matic" iron. It has an 8 oz capacity tank—sufficient to provide steam for about 45 minutes' ironing. The body and tank are of stainless steel and the manufacturers claim that ordinary tap water can be used for filling as the working parts do not come into contact with water.

It will be noted that Morphy-Richards, Ltd., who for many years were one of the few firms that marketed an iron with a porcelain body, have now discontinued this model. We understand that this was because of a lack of demand nowadays for irons of this type.

Manufacturer	Name or Model	Type	Weight	Loading	Special Features	Finish	Price (Excl. Tax)	Purchase Tax
A.E.I.-HOTPOINT, LTD., 33, Grosvenor Place, London, S.W.1.	Premier "Super Smoothwell" 835 · 833	Automatic	5 lb (835) 3 lb (833)	750 W	Pilot light, snap action thermostat	Chromium	£2 7 4	£0 8 8
	Premier "Nine-O-Nine" 909	Automatic	5 lb	1 kW and 800 W	Left or right handed, light in front of handle	Chromium	£4 2 5	£0 15 1
	Premier "Smoothwell" 814	Non-Automatic	4½ lb	450 W	Hard wearing	Chromium	£1 12 6	£0 6 0
BEST PRODUCTS, LTD., Felixstowe, Suffolk.	"Steam-O-Matic"	Automatic	3½ lb (dry) 3¾ lb (filled)	1 kW	Stainless steel body and tank, can be used with tap water	Stainless steel	£3 17 6	£0 14 2
BYLOCK ELECTRIC, LTD., South Street, Enfield, Middlesex.	"Victor"	Automatic, tilting safety	5 lb	750 W	Left or right handed	Pastel-primrose, blue or green	£3 2 6	£0 11 6
CO-OPERATIVE WHOLESALE SOCIETY, LTD., National Works, Hall Street, Dudley.	"Senior"	Automatic	4½ lb	800 W	—	Chromium	£2 5 0	£0 8 3
	"Major"	Non-Automatic	5½ lb	550 W	—	Chromium	£1 10 9	£0 5 8
	"Minor"	Non-Automatic	4½ lb	450 W	—	Chromium	£1 2 0	£0 4 0
FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1.	"Featherlight" 95658	Automatic	3 lb	750 W	Left or right handed, pilot light	Chromium	£2 2 0	£0 7 8
	"Pilot" 95707	Automatic	4½ lb	750 W	Left or right handed, pilot light	Chromium	£2 2 0	£0 7 8
	"Globetrotter" 95706	Travelling	2 lb	300 W	Folding handle, 110 and 200/250 V	Chromium	£1 15 8	£0 6 6
	"Globetrotter" De-Luxe 95706/DL	Travelling	2 lb	300 W	As above in travelling case with adaptors	Chromium	£2 15 4	£0 10 2
GATEHILL MANUFACTURING CO., LTD., Beco Works, Kennard Road, Stratford, E.15.	"Golden Arrow"	Automatic	5½ lb	750 W	—	Coloured body, chromium sole plate	£1 15 0	£0 6 4
	"Silver Arrow"	Automatic	5½ lb	750 W	—	All chromium	£2 1 0	£0 7 5
	"Beco Safety"	Non-Automatic	4 lb	450 W	—	Coloured body, chromium sole plate	£0 18 0	£0 3 3
	"Beco Safety"	Non-Automatic	4 lb	450 W	—	Chromium	£0 18 11	£0 3 5
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	"Superspeed" D.5851	Automatic	2½ lb (approx.)	750 W	Non-kink flexible, pilot light, snap-action thermostat	Chromium (a) or cream vitreous enamel (b)	£2 7 4 (a) £2 3 1 (b)	£0 8 8 (a) £0 7 11 (b)
	"Superspeed" D.5854	Automatic	4½ lb (approx.)	750 W	Non-kink flexible, pilot light, snap action thermostat	Chromium (a) or cream vitreous enamel (b)	£2 5 3 (a) £2 1 0 (b)	£0 8 3 (a) £0 7 6 (b)

Manufacturer	Name or Model	Type	Weight	Loading	Special Features	Finish	Price (Excl. Tax)	Purchase Tax
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. *(continued)*	D.5805	Standard	5 lb (approx.)	450 W	Streamlined	Chromium	£1 12 7	£0 5 11
	D.5827	Travelling	3 lb (approx.)	300 W	Fold flat handle, universal voltage	Chromium	£3 1 9	£0 11 3
GRAFTON HEATER CO., LTD., 13-15, Westland Place, City Road, N.1.	1	Non-Automatic	5 lb	450 W	Handle in various colours	Nickel plated	£0 19 0	£0 3 7
	2	Non-Automatic	5 lb	450 W	Handle in various colours, connector guard	Nickel plated	£0 19 6	£0 3 8
	6	Non-Automatic	5 lb	450 W	Heat indicator dial	Nickel plated	£1 7 11	£0 5 3
	7	Non-Automatic	5 lb	500 W	Complete with iron stand	Nickel plated	£1 12 6	£0 6 1
	8	Non-Automatic	7½ lb	600 W	Laundry type	Nickel plated	£1 5 6	£0 4 9
	9	Travelling	2½ lb	250 W	Detachable handle	Nickel plated	£0 14 6	£0 2 9
	10	Safety	3½ lb	500 W	Fixed thermostat, a.c. only	Nickel plated	£1 7 11	£0 5 3
	DD1 and DD2	Automatic	4½ lb	750 W	Pilot light	Primrose, green or blue (a), chromium (b), or chromium with coloured handles (c)	£1 17 6 (a) £2 2 6 (b) £2 7 6 (c)	£0 7 0 (a) £0 8 0 (b) £0 8 11 (c)
	DD3 and DD4	Automatic	4½ lb	750 W	Pilot light	Primrose, green or blue (a), chromium (b), or chromium with coloured handles (c)	£2 2 6 (a) £2 7 6 (b) £2 12 6 (c)	£0 8 0 (a) £0 8 11 (b) £0 9 11 (c)
L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, Kingsway, W.C.2.	"Universal" L.G.H.1330	Automatic	4½ lb	800 W (a.c. only)	Dial controls include on/off switch	Cream, blue or green	£1 19 0	£0 7 2
	"Hawkins" L.G.H.1310	Non-Automatic	4½ lb	450 W	Design similar to L.G.H.1330	Cream, blue or green	£1 6 6	£0 4 10
	"Hawkins" L.G.H.1315	Non-Automatic	4½ lb	450 W	Design similar to L.G.H.1330	Nickel plated	£1 7 6	£0 5 0

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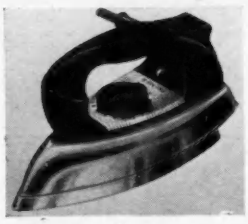

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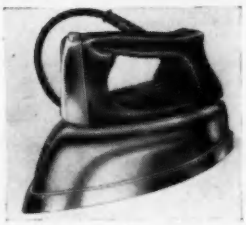

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1. *Bylock "Victor" safety iron*
2. *Premier "Super Smoothwell" automatic iron (A.E.I.-Hotpoint)*
3. *G.E.C. "Superspeed" automatic iron*
4. *Best Products "Steam-O-Matic" steam iron*
5. *Grafton model DD1 automatic iron*
6. *G.E.C. model D.5805 iron*
7. *L. G. Hawkins model L.G.H.1330 automatic iron*
8. *C.W.S. "Senior" iron*
9. *Premier "Smoothwell" iron (A.E.I.-Hotpoint)*
10. *Gatehill "Golden Arrow" automatic iron*
11. *Falk's "Globetrotter" de-luxe travelling iron*

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Manufacturer	Name or Model	Type	Weight	Loading	Special Features	Finish	Price (Excl. Tax)	Purchase Tax
H.M.V. HOUSEHOLD APPLIANCES, Hayes, Middlesex.	IC10	Automatic	4 lb	750 W	Left or right handed, pilot light	Primrose, red, blue or green	£2 0 2	£0 7 4
	IC10.LW	Automatic Lightweight	2¾ lb	1 kW	Left or right handed, pilot light	Chromium	£2 6 1	£0 8 5
HOOVER, LTD., Perivale, Greenford, Middlesex.	"Steam-or-Dry"	Automatic	3½ lb (dry) 4 lb (filled)	1 kW	Left or right handed, easy-to-read dial with 7 temperature settings	Chromium with brown plastic dial control and handle	£3 17 6	£0 14 7
JELSON ELECTRIC, LTD., Spring Road, Tyseley, Birmingham, 11.	MX20	Automatic	4½ lb	800 W	—	Chromium	£2 5 0	£0 8 3
LINCASS ELECTRIC, LTD., White Hart Yard, Guildford Street, Chertsey, Surrey.	134 and 144 (a.c./d.c.)	Non-Automatic	4½ lb	450 W	Left and right handed	Coloured (134) and chromium (144)	£1 5 6 (134) £1 7 6 (144)	£0 4 8 (134) £0 5 0 (144)
	434P and 444P	Automatic	4½ lb	750 W	Pancake selector dial, left and right handed, pilot light	Coloured (434P) Chromium (444P)	£1 19 6 (434P) £2 2 6 (444P)	£0 7 2 (434P) £0 7 8 (444P)
	436P (a.c./d.c.) and 446P (a.c./d.c.)	Automatic	4½ lb	750 W	Pancake selector dial, left and right handed, pilot light	Coloured (436P) Chromium (446P)	£2 2 6 (436P) £2 5 6 (446P)	£0 7 8 (436P) £0 8 3 (446P)
	444PH	Automatic	6 lb	1 kW	Pancake selector dial, left and right handed, pilot light	Chromium	£2 7 6	£0 8 8
	444PHS and 446PHS (a.c./d.c.)	Automatic	7 lb	1 kW	Pancake selector dial, left and right handed, pilot light	Chromium	£2 12 6 (444PHS) £2 15 6 (446PHS)	£0 9 6 (444PHS) £0 10 2 (446PHS)
METWAY ELECTRICAL INDUSTRIES, LTD., Canning Street, Kemp Town, Brighton, 7.	DA224 (*a*) DA226 (*b*) and DA225 (*c*)	Non-Automatic	5 lb	450 W	Nickel sole plate	Coloured (*a*), nickel (*b*) and chromium (*c*)	£1 2 4 (*a*) £1 2 9 (*b*) £1 5 0 (*c*)	£0 4 0 (*a*) £0 4 1 (*b*) £0 4 6 (*c*)
	DA439 (*a*) and DA446 (*b*)	Automatic	4½ lb	700 W	Chromium sole plate	Coloured (*a*) and chromium (*b*)	£2 3 9 (*a*) £2 4 6 (*b*)	£0 7 11 (*a*) £0 8 0 (*b*)
	DA186	Travelling	2 lb	150 W	Nickel sole plate	Nickel or coloured	£0 18 6	£0 3 4
	DA246	Travelling	2 lb	150 W	Complete with imitation crocodile case	Cream	£1 4 6	£0 4 5
MORPHY-RICHARDS, LTD., 50, Conduit Street, London, W.1.	"Senior" CA/75	Automatic	4½ lb	750 W	Pilot light, fabric selector, thermostatic control	Primrose, blue, red or green (*a*) and chromium (*b*)	£2 1 0 (*a*) £2 5 0 (*b*)	£0 7 5 (*a*) £0 8 2 (*b*)
	"Senior" CU/75	Automatic	4½ lb	750 W	Pilot light, fabric selector, thermostatic control, a.c./d.c.	Primrose, blue, red or green (*a*) and chromium (*b*)	£2 8 6 (*a*) £2 14 0 (*b*)	£0 8 9 (*a*) £0 9 9 (*b*)
	"Atlantic" LA/75	Automatic	2¾ lb	750 W	Pilot light, thermostatic control, fabric selector	Primrose, blue, red or green (*a*) and chromium (*b*)	£2 2 6 (*a*) £2 7 3 (*b*)	£0 7 8 (*a*) £0 8 6 (*b*)
	"Atlantic" LU/75	Automatic	2¾ lb	750 W	Pilot light, thermostatic control, fabric selector, a.c./d.c.	Primrose, blue, red or green (*a*) and chromium (*b*)	£2 8 6 (*a*) £2 14 0 (*b*)	£0 8 9 (*a*) £0 9 9 (*b*)

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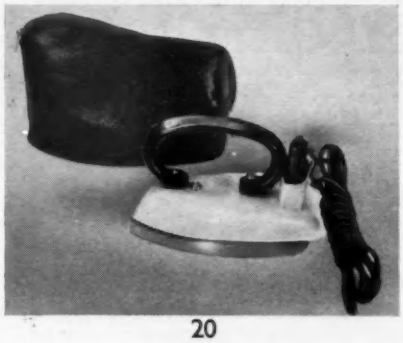

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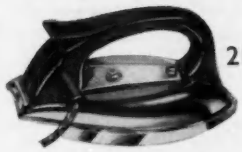
12. *Sims "Simfold" travelling irons*
13. *Lincass model 444P automatic iron*
14. *Jelson model MX20 automatic iron*
15. *Revo "Automatic" iron*
16. *Morphy-Richards "Steam-and-Dry" steam iron*
17. *Hoover "Steam-or-Dry" steam iron*
18. *Pifco model 1042 automatic iron*
19. *H.M.V. model 1C10 automatic iron*
20. *Metway travelling iron with case*
21. *Westerman "Welec Glide-Eesi" non-automatic iron*
22. *Morphy-Richards model CA/75 "Senior" iron*



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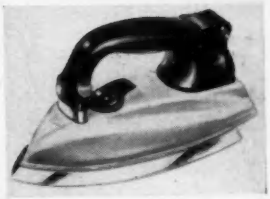

Manufacturer	Name or Model	Type	Weight	Loading	Special Features	Finish	Price (Excl. Tax)	Purchase Tax
MORPHY-RICHARDS, LTD., 50, Conduit Street, London, W.1. *(continued)*	"Power" AP/10	Automatic	6½ lb	1,000 W	Heavy duty, pilot light, thermostatic, fabric selector	Chromium	£2 12 6	£0 9 6
	"Power" UP/10	Automatic	6½ lb	1,000 W	Heavy duty, a.c./d.c., pilot light, thermostatic, fabric selector	Chromium	£2 17 6	£0 10 5
	"Steam-and-Dry" ZA/75	Automatic	3 lb (dry) 3½ lb (filled)	750 W	Pilot light, thermostatic, fabric selector, filler and de-scaling fluid	Chromium	£3 5 0	£0 11 9
	"Steam-and-Dry" ZU/75	Automatic	3 lb (dry) 3½ lb (filled)	750 W	Pilot light, thermostatic, fabric selector, filler and de-scaling fluid, a.c./d.c.	Chromium	£3 10 0	£0 12 8
OLIVER INDUSTRIES, LTD., 80, Gloucester Road, Croydon, Surrey.	"Oliver" Travel Iron	Single voltage (*a*) dual voltage (*b*) or dual voltage travel set (*c*)	1¼ lb	80 W	Leather style case with dual voltage travel set	Plastic and chromium	£1 7 0 (*a*) £1 11 3 (*b*) £2 1 5 (*c*)	£0 4 6 (*a*) £0 5 3 (*b*) £0 6 10 (*c*)
PIFCO, LTD., Watling Street, Manchester, 4.	1042	Automatic	5 lb	750 W	Streamlined, built-in pilot light	Chromium	£2 4 10	£0 8 2
T. PRICE & SON (STAMPERS), LTD., Spring Hill Passage, Birmingham, 18.	"Prilect" 2027A	Travelling	2 lb	150 W	Wooden handle	Nickel plated	£0 12 11	£0 2 4
	"Prilect" 2027B	Travelling	2 lb	150 W	Moulded handle	Chromium plated	£0 16 6	£0 3 0
	"Prilect" 2111	Travelling	2 lb	150 W	Moulded handle, universal voltage	Nickel plated	£1 3 9	£0 4 4
	"Prilect" 2085B	Automatic	4 lb (approx.)	700 W	Moulded handle	Chromium plated	£1 10 0	£0 5 6
	"Prilect" 2131	Automatic	4½ lb (approx.)	700 W	Moulded handle, pilot light	Chromium plated	£1 15 0	£0 6 5
	"Prilect" 2124	Non-Automatic	4 lb (approx.)	450 W	Moulded handle	Chromium (*a*) or nickel plated (*b*)	£0 19 2 (*a*) £0 17 6 (*b*)	£0 3 6 (*a*) £0 3 2 (*b*)

Manufacturer	Name or Model	Type	Weight	Loading	Special Features	Finish	Price (Excl. Tax)	Purchase Tax
REVO ELECTRIC CO., LTD., Tipton, Staffs.	"Automatic"	Automatic	4½ lb	750 W	Left and right handed thumb rest, pilot light	Chromium (*a*) or art enamel (*b*) or porcelain enamel (*c*) colours	£2 4 9 (*a*) £1 19 3 (*b*) £2 7 6 (*c*)	£0 8 2 (*a*) £0 7 2 (*b*) £0 8 8 (*c*)
ROBSON ELECTRICAL PRODUCTS, LTD., Ultralite Works, Union Street, West Bromwich.	"Explorer"	Non-Automatic	5 lb	450 W	—	Coloured or nickel plated	£0 19 6	£0 3 8
	"Ultralite"	Non-Automatic	5 lb	450 W	—	Chromium	£1 3 0	£0 4 2
	"Roblec"	Automatic	4½ lb	750 W	—	Coloured or nickel plated	£1 13 9	£0 6 4
	"Roblec"	Automatic	4½ lb	750 W	Pilot light	Chromium	£1 19 6	£0 7 6
	"Roblec Junior"	Travelling	2 lb	200 W	—	Coloured	£0 15 6	£0 2 11
SCOTTISH PRECISION ENGINEERING CO., LTD., 27, Cadogan Street, Glasgow, C.2.	"Rob Roy Superflow"	Automatic	4½ lb	750 W	Control knob in handle, pilot light	Chromium (*a*) and enamelled pastel shades (*b*)	£2 3 2 (*a*) £2 0 9 (*b*)	£0 7 9 (*a*) £0 7 4 (*b*)
	"Rob Roy Nu-flow"	Automatic	3¾ lb	500 W	Translucent knob acts as pilot light	Chromium (*a*) and enamelled pastel shades (*b*)	£1 17 0 (*a*) £1 14 6 (*b*)	£0 6 8 (*a*) £0 6 3 (*b*)
	"Rob Roy Handymaid"	Non-Automatic	4 lb	450 W	Finger grip handle	Chromium (*a*) and enamelled pastel shades (*b*)	£1 3 7 (*a*) £1 0 7 (*b*)	£0 4 3 (*a*) £0 3 8 (*b*)
	"Rob Roy Majestic"	Non-Automatic	5 lb	450 W	Finger grip handle	Chromium (*a*) and enamelled pastel shades (*b*)	£1 7 2 (*a*) £1 4 8 (*b*)	£0 4 11 (*a*) £0 4 5 (*b*)
SELEX ELECTRIC CO. (KIRKBY), LTD., Yardley Road, Kirkby Industrial Estate, Liverpool.	"Xcel" A.2004	Non-Automatic	5 lb	450 W	Left or right handed, reversible flex	Chromium	£1 12 6	£0 6 0
HENRY SIMS, 191, Goldhurst Terrace London, N.W.4.	"Simfold" Standard	Travelling	2 lb	300 W	Fold-flat handle	Chromium (*a*) and pastel colours (*b*)	£2 1 9 (*a*) £2 0 0 (*b*)	£0 7 7 (*a*) £0 7 4 (*b*)
	"Simfold" Universal	Travelling	2 lb	300 W	Fold-flat handle, 110–250 V range	Chromium (*a*) and pastel colours (*b*)	£2 9 0 (*a*) £2 5 0 (*b*)	£0 9 0 (*a*) £0 8 3 (*b*)
	"Mavec"	Non-Automatic	4½ lb	450 W	200/250 or 110/120 V	Pastel colours	£0 16 8	£0 3 3
SUNBEAM ELECTRIC, LTD., Norston, East Kilbride, Lanarkshire.	"Ironmaster"	Lightweight automatic	2 lb	875 W	Thumb-tip control incorporating "off" switch in handle	Chromium, primrose, blue or red	£2 8 0	£0 8 9
TELSEN ELECTRIC CO. (1935), LTD., Fitzgeorge Street, Rochdale Road, Collyhurst, Manchester, 9.	"Jubilee"	Non-Automatic	5½ lb	450 W	—	Nickel plated	£1 0 0	£0 3 9
	"Victory"	Automatic	7½ lb	650 W	—	Nickel plated	£1 15 0	£0 6 7
J. & H. WALTER, LTD., Garth Road, Morden, Surrey.	"Walter No-Cord"	Automatic	5 lb	900 W	Cordless and complete with ironing table	Cream	£9 17 6	£1 15 3
F. WESTERMAN (WHOLESALE), LTD., 94, Dale End, Birmingham, 4.	"Welec Glide-Eesi"	Non-Automatic	4 lb	450 W	Streamlined	Nickel plated	£0 16 4	£0 2 11

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23. *Sunbeam "Ironmaster" automatic iron*

24. *Selex "Xcel" non-automatic iron*

25. *Scottish Precision Eng. Co.'s "Rob Roy Superflow" automatic iron*

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Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

THE transient stability of the parallel operation of turbo-generators when short circuits in the system occur is always higher than its value calculated by the usual standard method. The greatest differences in this respect occur in the case of severe short circuits at points electrically fairly close to the terminals of the turbo-generators. The main reason for this is that the standard calculations do not consider the electromagnetic torques on the alternator shaft due to the aperiodic component of the stator current set up at the instant of fault inception or by other sudden variations of the operating conditions.

The resynchronisation of the turbo-generators of thermal power stations after loss of synchronism with respect to the other generating stations of the system in such cases is possible even when the sum of the outputs of the station turbo-generators which have fallen out of step exceeds the power which may be transmitted continuously over the lines remaining in operation. The unsynchronised operation and resynchronisation of turbo-generators with internal hydrogen and liquid cooling must be separately considered. These results were obtained by a detailed analysis of available experimental data and experience in the operation of large power systems and by comparing the results of exact calculations with those of the approximative standard method.—"Short Circuits, Unsynchronised Operation and Resynchronisation of Turbo-Generators," N. A. Polyak, *Elektrichestvo*, No. 11, pp. 18-24, 1958, in Russian.

Transistor Devices

This is the first complete report on the development of the "Tecnetron," for which the basic French patent was granted early in 1955 to the first of the present authors. The fundamental idea of the new transistor type is very simple and based on Shockley, Dacey and Ross's "unipolar field-effect transistor" in which an n-p semiconductor junction of laminar form is used. In this the conducting layer is ultimately reduced to a plane by the "striction" effect of the field applied and the effect of the external field depends on the depth of the barrier layer formed; theoretically it should be the inverse ratio of the square root of the field but in practice it is only proportional to the inverse cubic root.

By making the whole arrangement cylindrical, the conducting layer is restricted to the axis of the semiconductor, and this increases the effect of the voltage applied on the relative conductivity by a factor 3, or the conductivity at the same voltage applied by a factor 2. Also, the variation of the capacitance of the space charges with the voltage becomes much more rapid.

The development of actual examples of the "Tecnetron" has taken some time, but numerous models are now available. They are essentially minute n-type germanium rods with metal rings or "necks" round them and cathode and anode welded to their ends. By subdividing the "neck" into several rings, tetrode and pentode types were made; on the other hand, multi-rod combinations in comb or brush form of "Tecnetrons" will enable tecnetron-type rectifiers to be used for heavy-current purposes. Of the actual uses already made, 30 Mc/s oscillators and amplifiers are shown and described, and oscillators of 50 and 130 Mc/s are mentioned. A number of other applications is outlined.—"The Tecnetron, a New Stage of Development of Transistor Devices," S. Teszner and M. Thue, *Bull. Soc. Franc. Elect.*, Vol. 8, No. 94, pp. 683-700, 1958, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

High Purity Magnetic Iron

A survey of the methods used for obtaining iron of the highest purity in order to improve its magnetic characteristics to surprisingly high values, viz. relative permeabilities of the order of 4×10^6 and correspondingly low values of the coercive force, is presented. It is found that the impurities in the iron are largely responsible for impeding the movements and alignment of the Bloch walls, although not all of them have an effect. The latter depends on their composition and stability.

However, Neel's theory was brilliantly confirmed by the experiments carried out on the effects of impurities on the coercive field strength, since the contents of Fe_3C, Cu, Fe_2Ti, Fe_3Mo_2, Fe_2P, Al_2O_3, Fe_2W_2 and $FeBe_2$ cluster densely about the line representing Neel's prediction of the effects of these impurities on the values of the coercive force. It is now likely that C and N, and quite particularly the latter element, are mainly responsible for deterioration of the magnetic characteristics. The paper contains analyses showing the impurity contents of various well-known types of U.S.A. steels and of specially prepared steels of higher purity with and without hydrogen treatment showing what can be achieved by these methods.—"Magnetic Characteristics of High-Purity Iron and High-Temperature Hydrogen Treatment," A. Ferro and C. Sari, *Elettrotecnica*, Vol. 45, No. 9, pp. 529-536, 1958, in Italian.

Transformer Oils

In transformers of low rating and the higher voltage rating of 6-10 kV, without air dryers, the moisture content of the oil may go up to $1\text{-}1.5\times10^{-2}$ per cent, and will on an average be $0.6\text{-}0.7\times10^{-2}$ per cent. The moisture content and the dielectric strength of the oil are subject to considerable seasonal variations; the maximum moisture content and minimum dielectric strength are observed in summer, i.e. between May and September, and the dielectric strength may fall below its rated value, i.e. below 25 kV.

Oil sampling should be carried out during these periods and the tests should be used for compiling tables and graphs representing developments over many years. Observations on larger transformers showed that the ratio of maximum to minimum moisture content is on an average 2·25, but goes up to 2·75 (in one special case to 4·5) and the dielectric strength may also change by factors up to 3.—"Seasonal Variations of the Moisture Content and Dielectric Strength of the Insulating Oil in Transformers during Service," B. L. Glushkov and V. V. Puchkovskii, *Elekt. Stantsii*, No. 10, pp. 55-57, 1958, in Russian.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

26099. Wolseley Engineering, Ltd., and Drake, R. S.—Portable appliance for testing an electric wire fence. 17th October, 1955. (814283.)

32844. Associated Electrical Industries, Ltd.—High voltage accelerating tubes for charged particles. 14th November, 1955. (814390.)

1955

8616. Simmons, F. S. C.—Electric motors particularly for roller blinds. 23rd March, 1956. (814243.)

14396. Merlin Mouldings, Ltd.—Thermostatically controlled electrical heating units for heating and boiling liquids. 21st June, 1956. (814244.)

16753. Philips Electrical Industries, Ltd.—Circuit arrangements for synchronising the line deflection circuit in a television receiver. 10th June, 1955. (814245.)

17220. Cole, Ltd., E. K., and Davis, R. G.—Back-scatter measuring gauges. 14th June, 1956. (814286.)

23237. M-O Valve Co., Ltd., Cook, K. G., and Isaacs, G. G.—Low pressure thyratrons. 27th July, 1956. (814289.)

24471. Communications Patents, Ltd.—Radar simulating apparatus. 25th August, 1955. (814392.)

24995. General Electric Co.—Thermistor assemblies. 31st August, 1955. (814394.)

25939. Cole, Ltd., E. K., and Yates, J. K.—Tuning arrangements for radio receivers. 10th September, 1956. (814294.)

28450. Chromatic Television Laboratories, Inc.—Cathode-ray tubes. 6th October, 1955. (814298.)

32033. Igranic Electric Co., Ltd.—Adjustable voltage drives for electric motors. 9th November, 1955. (814458.)

32047. Egen Electrical, Ltd., and Hook, J. R. R.—Coaxial electrical components having a rotary operating shaft. 12th November, 1956. (814301.)

36446. Watson, K.—Electrical regulating apparatus, particularly for regulating temperatures and pressures. 26th September, 1956. (814305.)

1956

1157. British Insulated Callender's (Submarine Cables), Ltd.—Sealing ends for electric cables. 11th January, 1957. (814257.)

1257. Siemens-Schuckertwerke A.G.—D.c. switching arrangements which operate in dependence upon the current passed therethrough. 13th January, 1956. (814307.)

1847. Sepen, C. H.—Method for the artificial stabilisation of synchronous electrical machines. 19th January, 1956. (814463.)

2881. Westinghouse Brake & Signal Co., Ltd., and Martin, R. G.—Frequency convertor. 26th March, 1957. (814464.)

5567. Genest Gesellschaft für Isolierungen, W.—Highly active wide band absorbers for short radio waves. 22nd February, 1956. (814310.)

5971. Telefunken G.m.b.H.—Electric resistance heating filaments. 27th February, 1956. (814404.)

10936. General Electric Co., Ltd.—Electric incandescent lamps. 2nd February, 1957. (814314.)

10970. McDonald Furnaces, Ltd.—Electrical heating of kilns. 11th March, 1957. (814260.)

11017. Philips Electrical Industries, Ltd.—Circuit arrangements for measuring voltages. 11th April, 1956. (814315.)

12839. Electric & Musical Industries, Ltd.—Systems for monitoring electrical signals. 11th April, 1957. (814318.)

13495. Westinghouse Electric International Co.—Electric control systems for effecting a controllable transfer of power from an a.c. source to a load. 2nd May, 1956. (814368.)

14293. Standard Telephones & Cables, Ltd.—Automatic telecommunication exchanges. 3rd May, 1957. (814183.)

18085. National Research Development Corporation.—Transistor circuits. 12th June, 1957. (814185.)

22368. Electric Storage Battery Co.—Production of dry-charged electric battery plates. 19th July, 1956. (814476.)

22432. General Electric Co., Ltd.—Transistor circuits. 19th July, 1957. (814409.)

26680. Evans, D. J.—Electrolytic apparatus. 30th August, 1957. (814480.)

27528. Elektrokemisk A.S.—Gas collecting means for electrolytic aluminium smelting furnaces. 7th September, 1956. (814413.)

29112. Kienzle Apparate G.m.b.H.—Voltage regulating devices. 24th September, 1956. (814330.)

30134. Plessey Co., Ltd., and United Kingdom Atomic Energy Authority.—Heterogeneous nuclear reactors. 30th September, 1957. (814416.)

33241. Rheostatic Co., Ltd.—Control of combustion furnaces. 31st October, 1957. (814485.)

33767. Sylvania Electric Products, Inc.—Machine for manufacturing light-emitting electrical devices and adapted to provide a record of deflects in the devices. 5th November, 1956. (814214.)

34491. Berry Wiggins & Co., Ltd.—Electric heaters. 21st October, 1957. (814420.)

34982. British Thomson-Houston Co., Ltd.—Speed control of dynamo-electric machines. 18th October, 1957. (814217.)

35155. Pfenningsberg, P.—Switching systems for electrically driven washing machines. 16th November, 1956. (814488.)

35758. Mullard, Ltd.—Production of cathode-ray tubes. 13th December, 1957. (814421.)

38873. General Electric Co.—Automatic programming control. 20th December, 1956. (814425.)

38949. English Electric Co., Ltd.—Electrical connectors. 16th December, 1957. (814492.)

1957

2168. Sperry Rand Corporation.—Electric circuit structures including edge connectors. 21st January, 1957. (814220.)

4354. Midgley, A. M.—Electric cookers and like devices. 24th January, 1958. (814433.)

6314. Provincial Engineering, Ltd.—Cooling systems for an electrically powered travelling crane. 25th February, 1957. (814434.)

6568. General Motors Corporation.—Tuner devices for radio receivers. 27th February, 1957. (814500.)

7508. Lignes Télégraphiques et Téléphoniques.—Wave guide systems. 6th March, 1957. (814346.)

13367. Centre National de la Recherche Scientifique.—Ferromagnetic material for gyromagnetic effect and methods of manufacture. 26th April, 1957. (814506.)

19332. Siemens-Schuckertwerke A.G.—Electric motors. 19th June, 1957. (814510.)

22146. Westinghouse Electric International Co.—Apparatus for producing an electrical signal indicative of the magnitude of vibrations. 12th July, 1957. (814440.)

28414. Ericsson Telephones, Ltd.—Electromagnetic bells. 9th September, 1957. (814518.)

29373. Leitz, G.m.b.H., E.—Reflector arrangements for elongated tubular light sources. 18th September, 1957. (814354.)

29487. Westinghouse Electric International Co.—Apparatus for operating an electric arc lamp. 19th September, 1957. (814442.)

30219. Compagnie Générale de Télégraphie sans Fil.—Short wave aerial systems. 24th September, 1957. (814355.)

36459. Jack & Heintz, Inc.—Excitation circuit for brushless alternator. 22nd November, 1957. (814519.)

37766. Ateliers de Constructions Electriques de Charleroi.—Wound condenser and method of manufacture. 4th December, 1957. (814358.)

Automatic Trunk Switchboard

A new switchboard for establishing trunk calls direct through automatic equipment to any subscriber in Britain was commissioned at Middlesbrough on 23rd May, when the new telephone exchange was officially opened. The "automatic trunk switchboard" provides access to common automatic equipment in exchanges throughout the country, permitting any subscriber to be reached without the intervention of a distant operator. This method constitutes an intermediate step between the existing manual trunk procedure and fully automatic working. The Trunk Control Centre replaces an automatic exchange, and a new building has been erected for the purpose. A 6,000-line local automatic exchange has been installed by Siemens Edison Swan, Ltd., in the same building. Middlesbrough is to have trunk dialling by the end of 1960.

The Middlesbrough switchboard has 55 operators' positions giving access to trunk and local lines, three positions for handling incoming trunk calls and eight inquiry positions. The switchboard, which was designed, supplied and installed by Siemens Edison Swan, Ltd., uses automatic switches instead of cords and plugs to establish connections and employs a set of buttons known as a keysender to replace the dial. Automatic switching equipment associated with the switchboard embodies a high-speed motor uniselector and a searching switch that hunts for outlets at a rate of 200 per second, which is now to be in standard use by the British Post Office for high density trunk switching.

The new switchboard is an improved version of the trial installation commissioned at the Thanet exchange in 1954.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Aireborough.—U.D.C. 16th June. Equipmen for class "A" street lighting. (See this issue.)

Australia.—Southern Electricity Authority of Queensland, Brisbane. 31st July. 3·3 kV and 415 V auxiliary switchgear at Bulimba "B" power station. (E.S.B. 12233/59. Ten/39209.)*

Burma.—Burma Purchase Board. 15th June. Welding cable. (E.S.B. 12822/59. Ten/39331.)*

Dumfries.—County Council. 22nd June. Trunk road lighting equipment. (See this issue.)

Greece.—Greek General Air Staff. Telephone installations at three airfields. (GD/5115/59. Ten/39371.)*

India.—Director General of Supplies and Disposals, New Delhi. 10th June. P.v.c. house wiring cable. (E.S.B. 12221/59. Ten/39217.)* 26th June. Three 1,085lb vertical cross tube boilers. (E.S.B. 12224/59. Ten/39203.)* 15th July. Insulated wires. (E.S.B. 12808/59. Ten/39341.)*

Punjab State Electricity Board, Dhulkote (Ambala). 31st July. Carrier telecommunication and telemetering equipment. (E.S.B. 12219/59. Ten/39235.)*

Irish Republic.—Kilkenny County Council. 4th July. Electrically driven pumping plant. (E.S.B. 12910/59. Ten/39339.)*

New Zealand.—Dunedin Electricity Department. 19th June. P.v.c. insulated and bare copper cable. (E.S.B. 12604/59. Ten/39277.)* 10th July. P.v.c. rubber and paper insulated cable. (E.S.B. 12605/59. Ten/39279.)*

Posts and Telegraphs, Wellington. Diesel engine alternator sets ranging from 2 kW to 100 kW. (E.S.B. 12607/59. Ten/39278.)*

South Africa.—Union Tender Board, Pretoria. 22nd June. Eleven electronic regenerative repeaters. (E.SB. 12128/59. Ten/39222.)*

Stores Department, South African Railways, Johannesburg. 19th June. Lighthouse equipment, including radio beacon, diesel alternator sets, switchboard and power plant spares. (E.S.B. 12733/59. Ten/39336.)*

Sudan.—Posts and Telegraphs Department. 8th July. Hard drawn copper wire. (E.S.B. 12837/59. Ten/39351.)*

Tyrone.—Education Committee. 16th June. Electrical space heating and lighting installation at Carntall New County Primary School, and electrical installation at Omagh Academy. Chief education officer, Tyrone Education Committee, Education Offices, Omagh.

United States.—Bureau of Reclamation, Denver, Col. 16th June. One 100,000 kVA water-wheel generator for Hoover power plant. (E.S.B. 12109/59. Ten/39205.)*

West Hartlepool.—Corporation. 19th June. Electrical installation in a new craft block being built at Thornhill Special School. A. G. Sinclair, borough architect, Municipal Buildings.

Wigan.—Corporation. 17th June. Electrical installations in 36 bungalows. (See this issue.)

Workington.—Corporation. 18th June. Class "A" street lighting equipment. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Chingford.—Corporation. Electrical installation in new municipal offices (£11,990).—A. Tindall & Sons.

Edmonton.—Middlesex County Council. Electrical installation (stages 1 and 2) in Rowantree Secondary Modern School (£12,800).—A. Tindall & Sons.

Glasgow.—British Railways (Scottish Region). Supply of two diesel-electric rail travelling cranes, Dyce and Irvine.—Taylor & Hubbard. Supply, termination, through jointing and commissioning of telecommunications cables, Millerhill Marshalling Yard.—Enfield Cables.

Harpenden.—U.D.C. Installation of 52 fluorescent mercury vapour discharge lamps on the trunk road A.5 (£3,411).—Engineering & Lighting Equipment Co.

London.—L.C.C. Renewal of electrical installation at Shoreditch school (£3,129).—Alliance Electrical Co. Renewal and improvement of electrical installations in 426 dwellings at Totterdown Fields estate, Wandsworth (£16,252).—Holmes & Larkinson. Renewal and improvement of electrical installations in 398 dwellings at Totterdown Fields estate, Wandsworth (£15,828).—Holliday & Son (Electrical). Renewal and improvement of electrical installation at Haverstock County Secondary School, St. Pancras (£8,269).—Powis Electrical Co.

Woolwich Borough Council. Recommended. Electrical installations in 72 flats at Eltham Road (£4,465).—London Electricity Board.

Rochdale.—Manchester Regional Hospital Board. Recommended. Renewal of electric mains, etc., at Rochdale Infirmary (£5,441).—Sadler & Kinsey.

Tipton. — Corporation. Recommended. Supply and installation of street lighting equipment in twenty-seven roads (£8,361).—Midlands Electricity Board.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aberdeen.—Flats (40), at Ashgrove; Low & Usherwood, quantity surveyors, 257, West George Street, Glasgow.

Aldershot.—Houses (84), Heron Wood estate; H. B. Sales, town clerk, Town Hall.

Ashford (Kent).—Houses (50), Waterside House site, Willesborough; surveyor, 1, Elwick Road.

Banbury.—Houses (140), Neithrop estate; borough engineer, Municipal Buildings, Marlborough Road.

Barnsley.—Houses (114), St. Helens estate; borough engineer, Town Hall.

Batley.—Houses (266), off Mayman Lane; borough engineer, West House, Hanover Street.

Bedlington.—New offices for the U.D.C. (£42,000); A. K. Dennis, surveyor.

Birkenhead.—Two eight-storey blocks of flats, Mersey Mount; Wm. Thornton & Sons, Ltd., 38, Wellington Road, Liverpool.

Bishop Auckland.—Houses (74), Woodhouse Close estate; E. Pye & Son, builders, East Parade.

Blackburn.—Additional Technical College buildings (£250,000); Willink & Dod, architects, Cunard Building, Liverpool.

Blackpool.—Park School, Whitegate Drive; Grenfell, Baines & Hargreaves, architects, 58, Topping Street, Blackpool.

Blyth.—Ambulance depot for Northumberland C.C. (£10,000); county architect, County Hall, Newcastle-on-Tyne.

Three-storey blocks of maisonnettes (52 dwellings), Phœnix Street; D. W. Foster, borough engineer.

Bracknell.—Works extensions; E.M.O. Instrumentation, Ltd.

Braintree.—College of Further Education (£210,745); Geo. Tanner & P. O. Wicks, Ltd., High Garrett Works.

Brecon.—Proposed Council Chamber (£117,000); T. J. Williams, county architect, Rhyd Offices, Brecon.

Bristol.—Departmental store at Broadmead for British Home Stores; H. Fairweather & Co., Ltd., Hyde Works, Muswell Hill, N.10.

Three-storey ward block at Southmead Hospital and modernisation of St. Catherine's block at Stoke Park Hospital; M. O. Carter, secretary to Regional Hospital Board, 27, Tyndalls Park Road, Bristol, 8.

Burnham. — Grammar school (about £150,000); Bucks. county architect, County Offices, Aylesbury.

Cambridge. — Laboratory extensions; Spillers, Ltd., Station Road.

Cannock.—Headquarters depot, Watling Street, for Bowmaker (Plant), Ltd. (£300,000); A. R. Young, architect, 4, Parson Street, Dudley.

Chelmsford.—Office block; S.P.D., Ltd., Widford Industrial Estate.

Chertsey.—Flats (54), Slade Road, Ottershaw; Gregory Estates, Ltd., 21, Farncombe Road, Worthing.

Chester.—St. Clare R.C. church, Lache estate; J. Roddy, builder, St. Mark's Road, Saltney.

Coleraine (N. Ireland).—Factory for Genatosan; Schofield Bros., Ltd., Loughborough, Leics.

Darlington.—Civic Centre; E. A. Tornbohm, borough architect.

New premises at Blackwellgate for Westminster Bank, Ltd.; R. Brown, architect, 123, Victoria Road.

Dartford.—Remodelling pumping station at Darenth (£76,500, including machinery); Metropolitan Water Board, New River Head, Rosebery Avenue, London, E.C.1.

Durham.—Additions to Consett Technical College, fire station at Aycliffe, and renewal of electrical installation at Dipton R.C. School; county architect, South Street, Durham.

Eastleigh.—Municipal offices near Fleming Park; borough engineer, Town Hall, Eastleigh, Hants.

Edinburgh.—Houses (528), Muirhouse site; A. Steele, city architect, City Chambers, High Street.

Enfield. — Works extensions; Hunter Vehicles, Ltd., Crown Works.

Sixteen shops and maisonnettes, Baker Street; Townsend & Collins, Ltd., 129, Goat Lane.

Eton.—Houses (78), Iver Heath; R.D.C. surveyor.

Halifax.—New X-ray department at General Hospital; Richard Pickles & Partners, architects, 1, Harrison Road.

High Wycombe.—Major development of War Memorial Hospital; Powell & Moya, architects, 36, Great Smith Street, London, S.W.1.

Leamington Spa.—Offices and factory, White Street; Neale Wright & Co., Ltd., Central Chambers, The Parade.

London.—Office block, Bow Churchyard and Watling Street; Ley, Colbeck & Partners, architects, 51, Bishopsgate, E.C.2.

Infirmary block for Royal Hospital, Chelsea;

Sir Lindsay Parkinson & Co., Ltd., 6, Lambeth Road, S.E.1.

Centre block for Science Museum, South Kensington; Y. J. Lovell & Son, Ltd., 4, Endsleigh Gardens, W.C.1.

Five-storey block of 30 flats, Garratt Lane, Wandsworth; C. Lovett Gill, architect to Borough Council, 41, Russell Square, W.C.1.

Manchester.—Terminal building for City Airport; city architect.

Fallowfield Technical High School for Girls; A. Vincent Booker, architect, 28, Kennedy Street.

Merthyr Tydfil. — Expansion scheme (£400,000); Hoover (Washing Machines), Ltd., Pentrebach.

Newtown (Mont.).—County library, Park Street (£41,000); county architect, County Offices, Welshpool.

Northampton.—Factory and offices, Dallington Fields estate; Giesen & Wolff, Ltd., Victoria Road.

Northumberland.—Health centre, Tweedmouth (£20,000); C. C. Brown, county architect, County Hall, Newcastle-on-Tyne.

Norwich. — Dwellings (132), Vauxhall Street; city architect.

Penicuik.—Sub-divisional police headquarters; county architect, 32, Palmerston Place, Edinburgh.

Peterborough.—Houses (22); R.D.C. surveyor, 49/51, Priestgate, Peterborough.

Reading.—Ophthalmic unit, Royal Berkshire Hospital; J. F. Watkins & Partners, architects, 80, Easton Street, High Wycombe.

Redditch.—Factory, Arthur Street; Lan-Bar, Ltd., 19, Seymour Street, Birmingham, 12.

Scarborough.—Crematorium (£50,000); Plaxtons, Ltd., builders, Seamer Road.

Shrewsbury.—Erection of county administrative centre; C. H. Simmonds, county architect, Column House, London Road, Shrewsbury.

Somerset.—Grammar school at Keynsham; R. O. Harris, county architect, Park Street, Taunton.

Southampton.—Primary school at Kane's Hill, Thornhill; borough architect.

South Shields.—Factory extensions, Readhead Street, for Tyne Wire Rope Manufacturing Co.; Randle & Co., contractors, Back Dunelm, Sunderland.

Stanley (Co. Durham). — Civic hall (£44,000); Henry Ayton & Son, builders, George Street, Blackhill, Co. Durham.

Stevenage.—College of Further Education (£200,000); C. Miskin & Son, Ltd., Romeland, St. Albans.

Stockton-on-Tees.—Houses (156), Darlington Lane; Marsh, Ltd., builders, Grangefield Road.

New head Post Office, High Street, for the Ministry of Works; F. Shepherd & Sons, Ltd., contractors, York.

Sunderland.—Methodist church, Ettrick Grove; J. Potts & Son, architects, 57, John Street.

Additions to Southmoor Technical School; borough architect, Grange House, Stockton Road.

Wallasey. — Extensions at Gorsedale Modern School; Ernest Griffiths & Sons, heating and lighting consultants, The Temple, Dale Street, Liverpool.

Walsall.—Three-storey extension to Council House; M. E. Habershon, borough engineer.

Washington (Co. Durham).—Houses (118), Coach Road estate; Isaac Berriman, Ltd., builders, Fence Houses.

Weston-super-Mare. — Dwellings (67), Bournville estate; W. J. Pople & Sons, Ltd., Burnham-on-Sea.

Whitley Bay.—Extensions to fire station (£31,000); T. H. Rigby, contractor, Grand Parade, Tynemouth.

Wilton.—Houses (40); Robert Potter & Richard Hare, architects, de Vaux House, Salisbury.

York.—Dwellings (100), Chapel Fields estate; city architect.

Catalogues and Lists

COUNTING EQUIPMENT.—Pamphlet describing the company's range of counters, including special types for forward and backward counting and for subtraction and addition, etc.—**Stonebridge Electrical Co., Ltd.**, 6, Queen Anne's Gate, London, S.W.1.

DRYERS.—20-page booklet (77) describing the range of Holmes-Kemp dryers designed to prevent the formation of condensate in pneumatic control lines, eliminate freeze-up of control lines under winter conditions and to prevent the corrosion of lines, valves and controls, etc.—**W. C. Holmes & Co., Ltd.**, P.O. Box No. B.7, Turnbridge, Huddersfield.

GENERATORS.—Pamphlet giving particulars and prices of a range of a.c. and d.c. generators for close-coupling to small petrol engines.—**B.K.B. Electric Motors, Ltd.**, St. George's Works, Icknield Street, Birmingham, 18.

Brochure (G.14051) describing new brushless high speed marine alternators introduced by the company.—**British Thomson-Houston Co., Ltd.**, Rugby.

INSULATION MATERIAL. — Leaflet giving particulars of "Samica" mica paper insulation.—**Micanite & Insulators Co., Ltd.**, Empire Works, Blackhorse Lane, Walthamstow, London, E.17.

LIGHTING FITTINGS.—Illustrated 80-page catalogue of lighting fittings produced by the company, including fluorescent, tungsten, and cold cathode types and luminous and flexible grid ceilings, etc., together with a separate brochure dealing with the various types of illuminated ceiling equipment.—**Courtney, Pope (Electrical), Ltd.**, Amhurst Park Works, Tottenham, London, N.15.

MOTORS.—A series of nine catalogues and leaflets dealing with geared motor units, couplings, magnetic clutches and brakes, emergency slipping devices, belt drives and conveyor pulleys.—**Crofts (Engineers), Ltd.**, Bradford, 3.

Illustrated pamphlet describing the company's "Twyntorq" motors.—**General Electric Co., Ltd.**, Magnet House, Kingsway, London, W.C.2.

SWITCHGEAR. — 55-page catalogue (1001/58) covering the company's range of industrial type medium voltage switchgear.—**Ottermill Switchgear, Ltd.**, 82, Victoria Street, London, S.W.1.

TAPE SPOOLER.—Pamphlet (DC.12A) describing type A.11 tape spooler designed for handling paper tape in any of the three standard widths and primarily intended for use with the company's high speed tape readers.—**Ferranti, Ltd.**, Hollinwood, Lancs.

TOOLS.—30-page illustrated catalogue giving particulars and prices of the company's range of hand tools.—**Stanley Works (G.B.), Ltd.**, Rutland Road, Sheffield, 3.

TRANSFORMERS.—Leaflet (V.6) describing type 7766 multi-secondary voltage transformers designed for mass production testing of watthour meters.—**Smith Hobson, Ltd.**, Hersham Trading Estate, Walton-on-Thames, Surrey.

VENTILATING EQUIPMENT.—Illustrated brochures covering a power operated roofing shutter which provides rapid clearing of smoke and fumes and cowl extractor ventilators designed for natural controlled ventilation where storm protection is required.—**Templewood Hawksley**, Ventilation Division, 177, Corporation Street, Birmingham, 4.

WIRES AND CABLES.—Loose-leaf catalogue containing particulars of the wires and cables produced by the Wandleside Warren Wire Co., Ltd.—**Wandleside Cable Works, Ltd.**, 106, Garratt Lane, Wandsworth, London, S.W.18.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 8th JUNE

Bournemouth.—Grand Hotel, Firvale Road, 8 p.m. A.S.E.E. Bournemouth Branch. "Metal Rectifiers—Development and Present-Day Trends."

London.—White Hall Hotel, Bloomsbury Square, 6.30 p.m. A.S.E.E. Central London Branch. Annual general meeting.

Wembley Park.—Century Hotel, Forty Avenue, 7.30 p.m. A.S.E.E. North West London Branch. Annual general meeting.

MONDAY, 8th JUNE to FRIDAY, 12th JUNE

Bridlington.—Spa Royal Hall. Electrical Trades' Union Conference.

TUESDAY, 9th JUNE to FRIDAY, 12th JUNE

Newcastle-on-Tyne. — Old Assembly Rooms. Association of Mining Electrical and Mechanical Engineers. Annual conference.

TUESDAY, 9th JUNE

Brockenhurst.—Brockenhurst Manor Golf Club. I.E.E. Southern Centre. Golf meeting in aid of the I.E.E. Benevolent Fund.

Cardiff.—Angel Hotel, 7.30 p.m. A.S.E.E. South Wales Branch. Annual general meeting.

London.—Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club luncheon.

Great George Street, Westminster, S.W.1, 5.30 p.m. Institution of Civil Engineers. Annual general meeting.

Portsmouth.—Ministry of Labour and National Service, Lake Road, 7.30 p.m. A.S.E.E. Portsmouth and District Branch. Annual general meeting.

York.—Georgian House, Blossom Street, 7.30 p.m. A.S.E.E. York Branch. Annual general meeting.

WEDNESDAY, 10th JUNE

Birmingham. — Engineering Centre, Stephenson Place, 6.30 p.m. A.S.E.E. Birmingham Branch. Annual general meeting.

Bradford.—Midland Hotel, 7 p.m. A.S.E.E. Bradford Branch. Annual general meeting.

Eltham.—Eltham Green School, Queenscroft Road, S.E.9, 7.15 p.m. A.S.E.E. South East London Branch. Annual general meeting.

London.—45, Great Peter Street, Westminster, S.W.1, 7 p.m. Women's Engineering Society, London Branch. Annual general meeting.

THURSDAY, 11th JUNE

Wimbledon.—Prince of Wales Hotel, S.W.19, 7.15 p.m. A.S.E.E. South West London Branch. Annual general meeting.

SUNDAY, 14th JUNE to TUESDAY, 16th JUNE

Eastbourne.—Grand Hotel and Winter Gardens. Electrical Contractors' Association. Annual conference.

Commercial Travellers' Benevolent Institution

The half-yearly Court of Governors of the Commercial Travellers' Benevolent Institution will be held in the Wax Chandlers' Hall, Gresham Street, London, E.C.2, on Saturday, 20th June, at noon.